JAN 28 1929

ENGINEERING AND
MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

McGRAW-HILL PUBLISHING COMPANY, INC. January 26, 1929 TWENTY-FIVE CENTS PER COPY

KOPPERS-RHÉOLAVEUR
announce

That the Koppers Co., Pittsburgh, Pa., and the American Rhéolaveur Corp., Wilkes-Barre, Pa., have joined in the formation of a new corporation to control the sale of "rights to use" the Rhéolaveur process for concentrating ores and washing coal and to design and contract for the construction of ore dressing mills, anthracite breakers, and bituminous washeries.

Rhéolaveur is now successfully treating lead-zinc ores in the Tri-State district. Watch for our ad in future issues of *E. & M. J.*, giving results of this mill.

KOPPERS-RHÉOLAVEUR CO.

911 Coal Exchange Bldg., Wilkes-Barre, Pa.

120 Broadway
New York, N. Y.

934 Fulton Bldg.
Pittsburgh, Pa.

The Hub of 4 Important Industries

For nearly 60 years, Ingersoll-Rand has been an important hub around which four great industries have revolved—mining, tunnelling, contracting, and quarrying. Each of these industries has grown and prospered with the development of I-R machines.

Our endless experimental work—manifested in the improvement of old machines and the development of new ones—has been reflected in greater production and greater profits by all four industries.

The continued growth of these industries is shown by the following statistics of the world's production from American Bureau of Metal Statistics and Bureau of Mine Reports.

	1921	1924	1928
Copper	238,420 tons	819,000 tons	909,016 tons
Lead	402,479 tons	590,000 tons	656,000 tons
Zinc	215,614 tons	535,846 tons	622,744 tons
Crushed Stone	68,563,360 tons	103,318,660 tons	147,000,000 tons
Cement	71,348,474 bbls.	137,188,792 bbls.	183,000,000 bbls.

Write or call the nearest I-R Branch for details of any of the new I-R machines.

Ingersoll-Rand

57-RDM

11 Broadway, New York City

Volume 127 *Number 4*

ENGINEERING AND MINING JOURNAL

A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"

A. W. ALLEN, *Editor*

Associate Editors: E. H. ROBIE, A. H. HUBBELL, New York. GEORGE J. YOUNG, San Francisco. *Contributing Editor:* T. A. RICKARD, San Francisco. *Assistant Editors:* W. N. P. REED, H. D. KEISER and HOMAR L. JOHNSON, New York. *Publishing Director:* H. W. CLARKE

New York, January 26, 1929

Contents

Editorials 145

- Construction Supervision Should Not Be Divorced From Design
- Increased Tariff Protection Sought by Manganese and Steel Men
- Complacency Endangered by Search and Discovery
- Another Step in the Slow March of Flotation Litigation
- British Mining Companies and Technical Co-operation
- Keep Dust Out of Bearings, Eyes and Lungs

The Small Mill Problem 148
By IRA L. WRIGHT

Subsidence at Miami 151
Illustrations

Managerial Efficiency in Its Broadest Sense 152
By SAM A. LEWISOHN

Metal Coating as a Protection Against Corrosion 156

Can Pulp Thickening Be Simplified? 157
By E. G. HOWE

Drafting Standards for Line Work 160

Anti-friction Bearings Cut Power Cost on Aerial Tramways 165
By D. C. SHERMAN

Cost Cutting Innovations	161	Personal Notes	168	Mining Stocks	184
Comment and Criticism	163	Obituaries	168	Professional Directory	22
By the Way	164	Mining News	169	Searchlight Section	24-25
Industrial Progress	165	Market and Financial News	180	What and Where to Buy	26-28
		Market Report	182	Advertising Index	30

A Suggestion to E. & M. J. Subscribers

SUBSCRIBERS resident outside the United States will greatly assist the publishers if they will send in their renewal orders promptly. Gaps in the service are to be avoided, and those who are thousands of miles away will render aid in preventing this if renewal instructions reach us before or very soon after the expiration date.

Notices are sent ninety days in advance to the more distant subscribers. But you can determine the expiration date of your subscription by referring to the impression of the stencil used in addressing your copies. The figures at the right on the top line tell the story; the first numeral the month, the second the year, of expiration. For example—J8-29 would be a subscription due to expire in August, 1929. So, whenever you want to be on the safe side, don't wait for the notice but send along the renewal order. Your co-operation will be greatly appreciated.

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. McGRAW, Chairman of the Board
MALCOLM MUIR, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
HAROLD W. McGRAW, Vice-President
C. H. THOMPSON, Secretary

NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

Cable Address: "Machinist, N. Y."

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal
Ingeniería Internacional — Food Industries
Electrical World — Electrical Merchandising
Bus Transportation — Electric Railway Journal
Construction Methods — Radio Retailing

Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

SUBSCRIPTION PRICES: United States, $6 a year. U. S. possessions, Canada, Mexico, and the countries of Central and South America, $7.50 a year. All other foreign countries, $10 a year. Single copy, 25 cents. Published weekly. Entered as second-class matter, June 20, 1879, at the Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

CHANGE OF ADDRESS

Subscribers are requested to send both the old and the new address when they move to a new address.

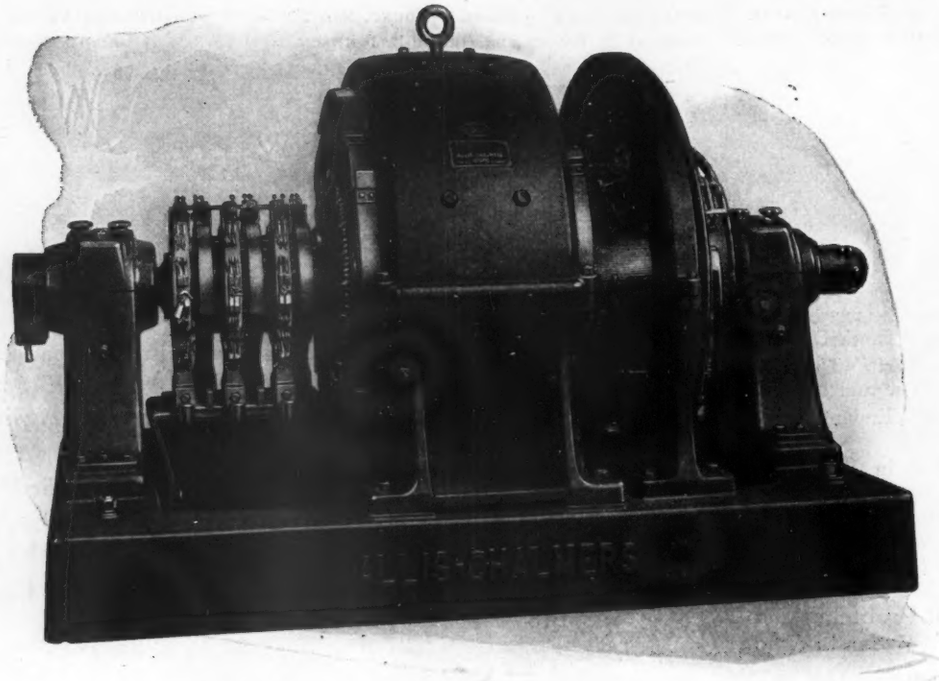
Copyright, 1929, by
McGraw-Hill Publishing Company, Inc.

Member—Audit Bureau of Circulations.
Member—Associated Business Papers.

11,193 Copies Printed This Issue

Total Number of Issues to Date, 3,266

ALLIS-CHALMERS



1000 K. W., 600 Volt D. C., 6 Phase, 60 Cycle, 900 R. P. M., Rotary Converter.

Rotary Converters

Allis-Chalmers Rotary Converters are made in various capacities from 100 kw. up, and are adapted to various kinds of municipal and railway service, industrial service, mines, steel mills and many other installations. They are equipped with Frog-Leg windings, insuring perfect commutation under all conditions of load.

Evidence of their superior design and workmanship is found in years of constant service performed.

Send for Bulletin.

PRODUCTS:

Electrical Machinery
Gas Engines
Steam Engines
Steam Turbines
Condensers
Oil Engines
Hydraulic Turbines
Pumping Engines
Centrifugal Pumps
Mining Machinery
Metallurgical Machinery
Crushing Machinery
Cement Machinery
Flour Mill Machinery
Saw Mill Machinery
Air Compressors
Air Brakes
Steam and Electric Hoists
Farm Tractors
Power Transmission Machinery

ALLIS-CHALMERS MANUFACTURING CO.

MILWAUKEE, WIS. U.S.A.

District Offices in All Principal Cities

ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
James H. McGraw, *Chairman of the Board*
Malcolm Muir, *President*
H. C. Parmelee, *Editorial Director*

A. W. Allen, *Editor*

H. W. Clarke,
Publishing Director

Volume 127 — *New York, January 26, 1929* — Number 4

Construction Supervision Should Not Be Divorced From Design

THE architect of the old school supplied the plans of a building only. The client had to look elsewhere for someone to take charge of construction according to those plans. The architect was co-operative, of course—willing to give professional advice to his client and to those assigned the job of translating his ideas on comfort, convenience, permanence, and appearance into tangible form. His was the conception; theirs, the realization. His was the abstract idea, on paper; theirs, the expression of that idea in the form of a building. If the contractor or his workmen erred in the interpretation of the plans, or skimped in service or material, or sacrificed appearance or stability to extra profit, the architect was available, at intervals, to report on progress, to detect the shortcomings of the contractor, and to suggest what should be torn down to correct a mistake the result of inferior craftsmanship. The client welcomed the intervention of the specialist, but he had to wait that much longer for his house.

A new order has replaced the old. The prospective house owner entrusts both design and supervision of construction to the architect, with the result that time and money are usually saved, worry over details of which the average citizen has no technical knowledge is avoided, and disappointment and recrimination are reduced to a minimum.

Why not the application of the same progressive idea to the design of a metallurgical flow sheet and the construction of a mill? The time has surely come when the metallurgist should expand his activities beyond the confines of purely consulting work. Like the architect, he should be an expert in research and design; but he, and he only, should be the one to translate the design into practice, as exemplified in an operating mill. Opportunity offers for a combination consulting and construction service by metallurgists of experience and high standing in the profession. To advise and then retire from the scene is as futile a proceeding in metallurgy as it was proved to be in architecture. In the order of their importance, the citizen wants a comfortable and attractive home, easy to manage, economical to pay for and keep in order. The mining company wants, first of all, a mill that will operate efficiently and profitably. To divorce the design of such a mill from its construction —to take the ideas of a metallurgical specialist and put them in the hands of a construction gang under non-technical or semi-technical authority and supervision—is to invite unnecessary expense, inevitable delay and, possibly, disaster. The alternative—unified design and construction—encourages greater accuracy in preliminary work, and the application, while construction proceeds, of those niceties and refinements in equipment layout that usually improve ultimate results and bring satisfaction to all concerned.

Increased Tariff Protection Sought by Manganese and Steel Men

TWO EVENTS of significance to domestic manganese producers took place on Monday, January 14: The president of the American Manganese Producers Association, Mr. J. Carson Adkerson, appeared before the Ways and Means Committee of the House of Representatives with a brief defending the present tariff on manganese ore and asking for an increase. Under the prevailing tariff the metallic manganese content of ore, in excess of 30 per cent, is dutiable at 1c. per pound. Mr. Adkerson asked that the rate be raised to 1½c. This, he argued, would put manganese ore producers on a parity with those engaged in mining lead and zinc ores, so far as protection was concerned, and would still leave the rate less by ⅜c. than the duty on manganese imported in the form of ferromanganese. The justice of this claim is at once apparent: the tariff act of 1922 provides a duty of 1½c. per pound on the lead content of lead-bearing ores and mattes of all kinds, and a similar rate on the zinc in zinc-bearing ores when it is in excess of 25 per cent. Incidentally, the only zinc ores on the free list are those containing less than 10 per cent of zinc, in contrast to manganese ores containing 30 per cent or less of metal, which may come in duty free.

The second event referred to was the appearance of Mr. John A. Topping, vice-president of the American Iron and Steel Institute, before the Ways and Means Committee with a request for a readjustment upward of the present rates on iron and steel products. "Under the conditions of cheap labor prevailing abroad and other competitive conditions, and without adequate protection, stabilization of this industry is impossible, and without stabilization the maintenance of existing wage scales is impossible," said Mr. Topping.

Here the outstanding fact is that the steel industry is seeking a higher rate of protection for its products. This should interest manganese ore producers, who recall the opposition to the tariff on manganese ore that the steel producers have evinced on more than one occasion. Memories go back to the historic Cleveland meeting on manganese on April 19, 1927, when the chief spokesman, a man long identified with steel production, declared: "It is obvious that the existing tariff on manganese should

be repealed. It fosters no industry and depletes our too scanty reserves of this essential raw material." Manganese producers have also heard on more than one occasion, and recently, that the steel manufacturers intend to continue to oppose the limited protection that manganese now enjoys.

The situation, therefore, is that the steel industry asks, on the one hand, increased protection for its products, and, on the other hand, demands that one of its essential raw materials, manganese ore, be admitted duty free. The selfishness of this attitude, it is hoped, will not escape the attention of members of the committee or of the members of the Tariff Commission.

Far better would it be if the steel men, serene in their enjoyment of a prosperity largely based on a protective tariff, would seek to insure the continuance of their well-being and to safeguard their vitally important industry, with respect to both peace and war, by making themselves independent of the foreign sources from which they are now drawing most of the 800,000 tons of manganese ore they annually use in making steel. This they can do in the course of a few years if they will help to secure adequate protection for the domestic manganese industry instead of opposing it. The cost of such protection when distributed, first, over their entire annual production of steel and then over the manufactured products made of steel, will be seen to be a mere bagatelle—a trifle that the ultimate consumer will never feel. Given this protection, moreover, the domestic manganese producers will not be hampered by lack of manganese reserves on which to draw. The existence of a huge tonnage of low-grade manganiferous materials in the Lake Superior region and elsewhere throughout the country is now well known. It can be made available if the price obtainable for ore and concentrates be high enough, and this reduces to a question of the adequacy of the tariff.

The request of the manganese producers for an increase in the tariff on imported ore is entirely reasonable. Great advantages will be achieved by the further development of a domestic manganese industry. They should not be ignored.

Complacency Endangered by Search and Discovery

THE situation in regard to borax affords an interesting study in economics. World consumption, compared with many other non-metallic minerals, is small. The borax equivalent of the principal minerals produced is probably about 150,000 tons or less per annum. Production has been derived from the United States, Chile, Peru, Argentina, Italy, and Asia Minor, with the greatest coming from the United States. Until comparatively recently, colemanite was the principal source of borax. However, the solution of the Searles Lake potash problem resulted in the production of a considerable amount of byproduct borax, about 50,000 tons per annum. This caused a weakening of price.

The next happening of importance was the discovery of kernite in large deposits. Production of this mineral, easily converted into borax, caused a further weakening in the price. Mining of colemanite almost ceased, and the principal sources of borate compounds are now the kernite deposits near Kramer, Calif., and the byproduct borax of Searles Lake, Calif. Chile, Peru, and Argentina are out of the picture, and Asia Minor supplies only a small amount of boracite, from which boracic acid is manufactured. Until some new use for colemanite is discovered, it will remain unimportant.

A reliable authority states that the first kernite deposit exploited can easily take care of the borate demand of the world for many years. This deposit averages about eighty feet thick, over an area of forty acres, and is mined by underground methods. Another deposit has also been discovered and plans have been made for its exploitation.

Known reserves of borate materials, in the form of kernite and as byproduct borax, are more than sufficient for present demands. Distance to tidewater is not great. Mining and production costs are relatively low. As yet the prevailing low price of borax has not stimulated a larger demand; but with the potential supply so greatly in excess of ordinary requirements, a gradually increasing consumption should result. New uses for borate compounds are needed, and research in this direction is appropriate.

Another Step in the Slow March of Flotation Litigation

FLOTATION LITIGATION is not so much before the public as it was a few years ago, inasmuch as most of the important mining companies now have licenses from the patentees of the machines or processes they use and are thus exempt from legal difficulties on this score; also, the patents that have been the subject of most of the litigation have expired. The matter is not entirely dead so far as the leading patent-exploiting company is concerned, however, as was made evident by the decision just handed down by the United States Circuit Court of Appeals, for the First Circuit, reversing the decision of the Federal District Court for Maine made last February, in the Minerals Separation suit against the Magma Copper Company.

Many will recall the fact that Magma, when the suit was tried in 1923, was using alpha-naphthylamine, or X-cake, in pneumatic cells, which practice Minerals Separation claimed was a violation of its so-called soluble frothing agent patent, No. 962,678. After thinking the matter over for four-and-a-half years, or, perhaps more accurately, having the opportunity to do so, Judge Peters decided to uphold Minerals Separation's stand, the patent in question having expired in the meantime. The present decision reverses the earlier one.

From the opinion it appears that the Appellate Court confined its attention to only one of several defenses put forward by Magma, apparently finding that single defense sufficient to dispose of the case to its entire satisfaction. Judge Bingham, in his opinion, accepted the Magma contention that all the flotation agents of the first Minerals Separation patent, No. 835,120, are soluble to some extent, as indeed everything is, the characteristics of solubility or insolubility being purely relative. Further, the Court found that such a substance as phenol was

available as a flotation agent under patent No. 835,120, and that when used in the small quantity therein recommended it goes wholly into solution, thus establishing a practice that antedated and made void the claims of the soluble frothing agent patent No. 962,678, even when those claims are restricted to flotation agents that go wholly into solution. This reasoning was directly contradictory to the decision of the Third Circuit Court of Appeals in 1917, in the case against the Miami Copper Company, so Judge Bingham said, "We, therefore, decline to follow the decision in the Miami case."

Reading of the seventeen pages of the decision does not impress one with the fact that Judge Bingham has finally clarified this highly complex technical matter, and it is interesting to observe that Judge Anderson "concurs in the result" without committing himself as to the reasoning. Minerals Separation feels that Judge Bingham has misinterpreted some of the earlier decisions, particularly the findings in the Butte & Superior case, and will petition to the U. S. Supreme Court for a writ of certiorari. This, if granted, will give the justices of that eminent body a technical problem that even the best engineers find puzzling. Of course, it is hoped by the appellant that the Supreme Court will do as it did twelve years ago in the Hyde case, and ten years ago in the Butte & Superior litigation, and reverse the findings of the Circuit Court of Appeals.

The matter is of no great importance to companies other than Minerals Separation, Magma Copper, and perhaps National Lead, for the last-named is also defendant in two cases that have been pending the outcome of the action against Magma. Other companies of any importance are licensees, or are making use of expired patents. No one will regret, not even the lawyers, we surmise, when this long and unpleasant litigation is finally ended.

British Mining Companies and Technical Co-Operation

ANNUAL REPORTS of British mining companies that have recently reached this office indicate a commendable liberality in the dissemination of technical details of operation that bodes well for an extension of international co-operation already established in the world of science. Official statements from the Burma Corporation, Mount Lyell Mining & Railway, Frontino & Bolivia, and Broken Hill South are outstanding examples of this tendency. Likewise, in recent months *Engineering and Mining Journal* has noted a welcome change in the policy of St. John del Rey, the Brazilian gold producer, always considered as the last word in secretiveness in technical matters.

This growing tendency represents nothing revolutionary. In fact, it is the beginning of a change long overdue. High standards of engineering practice are invariably attributable to a generous spirit of technical co-operation. Failure of mining companies to adopt so open-minded a policy has been responsible to a large extent for the unsatisfactory conditions prevailing in several mining districts throughout the world. Gratifying is the realization that secrecy is being discarded and that contributions to the modernization of engineering practice everywhere are being considered a duty as well as a privilege.

Keep Dust Out of Bearings, Eyes and Lungs

DUST REMOVAL is a matter of dollars and cents, from whatever point one views it. To install a dust-collecting system costs something—much or little, depending on the specific application and the quality of the job. The amount can be determined easily by soliciting bids. Estimates will vary widely, ranging from that of the tinsmith who looks upon the task as a mere matter of constructing housings, with perhaps a fan or two at some carelessly determined point, to that of the engineer who thoroughly understands the problem involved, with its various ramifications. Here it should be borne in mind that, as in any other installation intended for permanent use, work of good quality will be cheaper in the end. Some dust-collecting "systems" have been worthless from the start.

To do without a dust-collecting system will cost something also, wherever a plant has dusty air. This will be appreciated only when the operator comes to realize the ravages that dust can work. Perhaps it is because men have so long been looked upon as children of the dust, returning to it at the expiration of their days, that so many plant executives take dust as a matter of course. What is more natural than dust? We find it all about us. The wind blows it in our faces. The housewife is continually removing it from the furniture. So one should not be surprised if, in places, its presence in the air breathed by workmen from morning until night is ignored or considered lightly. Only when the condition becomes so obnoxious as to demand a remedy does it get attention.

Wherein may dust, perhaps intrinsically worthless, cause a loss? That it must be injurious to health, if sufficient in quantity, every one knows. On this account alone it is safe to say that the day will come when in every state dust prevention will be prescribed by law as an ordinary precaution wherever men are engaged in work. The quicker industry is to adopt the remedy, the less onerous will be the legislation that must eventually be passed.

Second, dust causes excessive labor turnover. No one prefers to work in dust and breathe it if another job can be found where the pay is as good and the conditions are pleasanter. Labor turnover and its effect on profits is a matter to which executives have given much attention. Dustiness in a plant will be found to be an influential factor. And even if dust does not actually drive a workman to seek employment elsewhere, it most certainly will make him less efficient by the annoyance and irritability it causes, in addition to its effect on his health in general. How illogical it is, moreover, in this day of the antifriction bearing and better lubrication practice—both devised to make machinery more efficient, to make it last longer, and to consume less power—to permit a condition of dustiness to continue, when dust tends to prevent the attainment of these three objectives! Dust in bearings is responsible for a goodly portion of the annual repair bills.

In short, dust causes a lot of trouble about a plant, directly and indirectly, and its removal is worth considering. Many a company outside of the mining industry would not think of operating without the adjunct of a dust-removal system. That the mine operator, so efficient underground and in his metallurgical work, so often lags behind his brother executives in other industries in this respect is indeed curious.

APPLYING MODERN PRACTICE

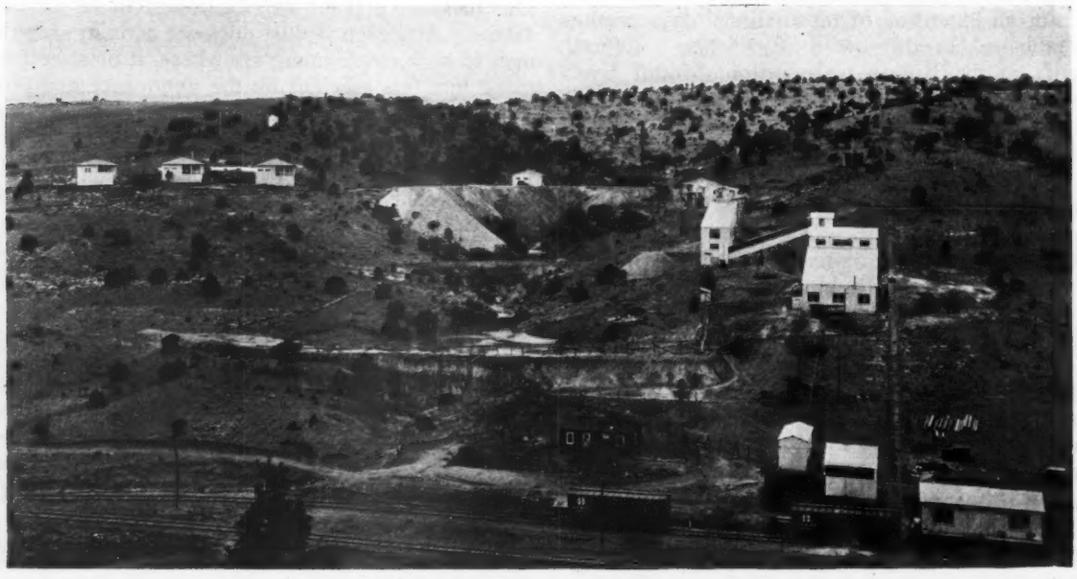
THE SMALL MILL PROBLEM

By IRA L. WRIGHT
Manager, Black Hawk Consolidated Mines, Silver City, New Mexico

THE PROPERTY of the Black Hawk Consolidated Mines Company consists of three major groups of claims in Grant County, N. M. The original, or Black Hawk, group is in the Bullard's Peak district and was at one time a notable producer of high-grade silver ore. Primarily, the company was incorporated to develop this ground. After considerable pumping and cleaning out of the old workings, with little new development work, the activities of the company were transferred to the Central district, where the Lucky Bill and Combination groups had been acquired. The former had been a producer of lead and copper ore for twenty years. It is now producing smelting ore in a small way, and development is being carried on with good prospects of opening more direct-smelting ore, or complex ore, such as the high-grade lead-zinc-copper ore recently developed in the Ground Hog claim adjoining the Lucky Bill on the north.

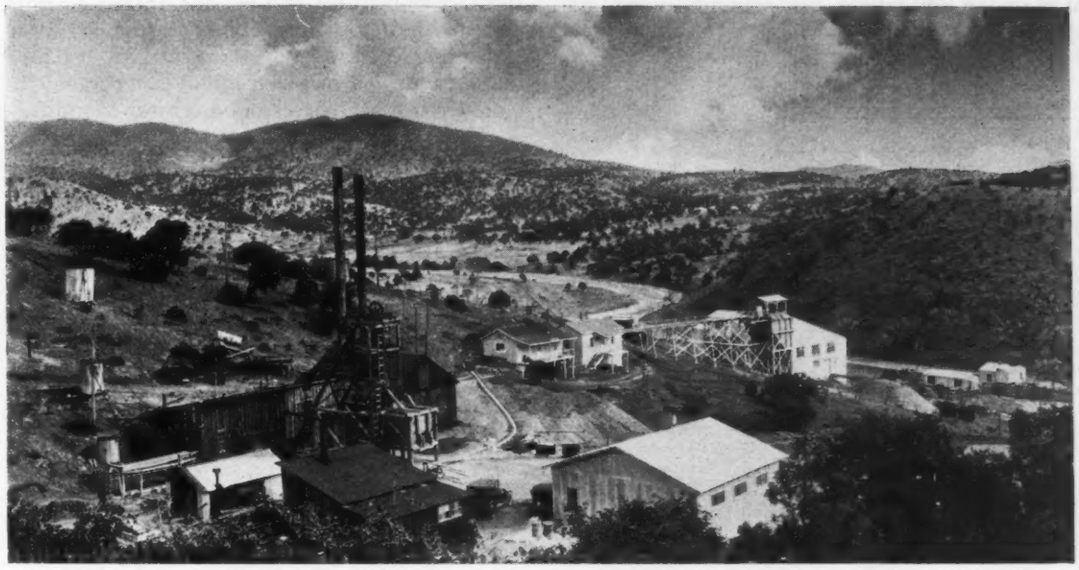
Recently, the greater part of the work of the company has been the development of the Combination group, which extends from one to two miles south of Hanover. On the Combination claim of this group a shaft has been sunk 625 ft., and levels have been run at depths of 120, 200, 300, and 525 ft. The total of all development, lateral and vertical, is about 6,500 ft. This includes the partial development of about 700 ft. along an ore zone that extends through the property for 6,000 ft. Before building the mill, it was estimated that 80,000 tons of ore, averaging 2 oz. silver, 1.6 per cent lead, 0.5 per cent copper, and 15 per cent zinc, was in sight. Stoping of the various orebodies indicates that this tonnage will be exceeded without further development, which, however, is being carried on as the ore is mined.

In this district the limestone ores occur mostly in the Pennsylvanian and Mississippian beds. Of these two, the latter, locally called Lake Valley, and about 400 ft. thick, has been the more productive. The former is divided into two beds known locally as the upper and lower Magdalena, each about 400 ft. thick. In the Combination group the surface exposes upper Magdalena



The Black Hawk flotation mill, with concentrate thickener, filter plant, bin, and railroad connection in the foreground

AND UP-TO-DATE EQUIPMENT TO

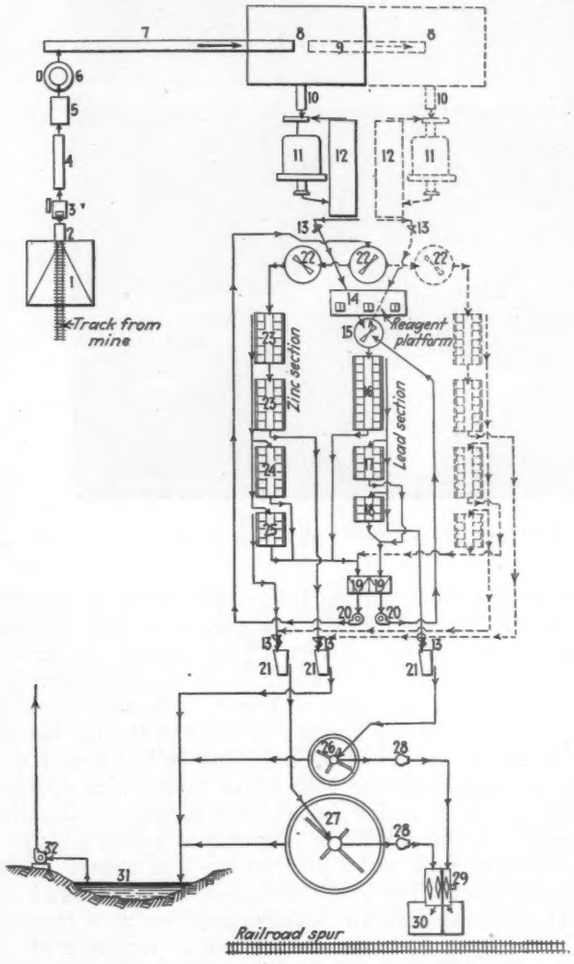


The property of Black Hawk Consolidated Mines, in Grant County, N. M.

only, but all three beds have been penetrated by the shaft. The 525-ft. level penetrates only the upper 50 or 60 ft. of the Lake Valley, except where faulting has brought a part of this level an undetermined distance further down in the bed. Ore has been found and is being mined from all four levels. It is expected that the fifth, or 625-ft. level, will be the most productive, inasmuch as it will be about in the middle of the Lake Valley bed, which, as stated above, is the most productive of the three. Porphyry dikes, parallel to fractures which seem to influence ore deposition, are found. The ore occurs principally in a metamorphosed limestone, the predominating gangue mineral being hedenbergite, but garnet is common. Considerable iron pyrite accompanies the ore, and large bodies of this mineral of no value occur, but usually near the zinc-lead orebodies. Metallurgical tests made before building a mill indicated that the ore was well suited to selective flotation. This has been proved by operation of the 100-ton mill, which was designed, built, and placed in operation by the Southwestern Engineering Corporation. The Black Hawk mill is on a natural slope below the mine shaft and above a spur of the Santa Fé railroad. Crushing plant and mill building were designed to handle 200 tons daily. The concentrating equipment now installed will treat 100 tons daily. Ore from this mine—a complex sulphide of lead, zinc, and iron—is trammed over platform scales to a crude-ore bin of 150 tons' capacity. From this bin it is fed by means of a 24-in. steel apron feeder to a 15x24-in. Traylor jaw crusher; and thence, by a 16-in. belt conveyor equipped with a magnetic head-pulley, to a short sorting belt, where waste is rejected. From the sorting belt the ore goes to a 2-ft. Symons cone crusher, which delivers a ½-in. product to the mill bin, also of 150 tons' capacity. A Southwestern ore sampler takes a cut from this feed for moisture and as a check on the head sample. From the storage bin the ore is fed by means of a Southwestern belt feeder to a No. 66 open-discharge Marcy ball mill, which operates in closed circuit with a duplex Dorr classifier. Classifier overflow, containing 32 to 34 per cent solids, goes to a conditioning tank and thence to the lead section of the flotation plant. The lead flotation section consists of one 12-ft. Southwestern air flotation machine as a rougher, followed by an 8-ft. cleaner and a 6-ft. recleaner of the same type. The cleaner and recleaner tailings are returned to the lead conditioner through a 2-in. Wilfley sand pump, and the rougher tailings are pumped by a similar companion pump to the first of two zinc conditioners. Series conditioners are used in the zinc flotation unit to give sufficient time to conditioning, obviating excessively large units. From the zinc conditioners the pulp enters the zinc flotation section, consisting of two 12-ft. Southwestern air flotation machines in series as roughers, followed by one 12-ft. cleaner and an 8-ft. recleaner of the same type. Concentrates from the first rougher and the upper third of the second rougher go to the cleaner, and the remainder of the second-rougher concentrates, with the cleaner and recleaner tailings, are returned to the zinc conditioner. Tailing from the second zinc rougher is laundered to a tailing pond, from which clear water is recovered and returned to the mill-

The Black Hawk Consolidated Company's plant in New Mexico has a simple though efficient flow sheet, requiring a small labor force and producing excellent results.

water supply tank. Automatic pulp samples of mill heads, lead concentrate, zinc concentrate, and mill tailing are obtained with the Southwestern automatic pulp samplers. In addition, three laboratory-size Wilfley tables cut in on the lead tailing, zinc concentrate, and mill tailing, giving a continuous visual sample of the mill



Flow sheet of the Black Hawk Consolidated mill, in Grant County, N. M.

1. Coarse-ore bin.
2. 24-in. apron feeder.
3. 15x24-in. jaw crusher.
4. 16-in. belt conveyor.
5. 30-in. picking belt.
6. 2-ft. Symons cone crusher.
7. 16-in. belt conveyor.
8. Fine-ore bin.
9. 16-in. belt conveyor.
10. 16-in. Southwestern belt feeder.
11. No. 66 Marcy ball mill.
12. 4-ft. 6-in. x 18-ft. Dorr classifier.
13. Southwestern pulp samplers.
14. Southwestern reagent feeders.
15. 5x5-ft. Southwestern conditioner.
16. MB-3012 Southwestern air flotation machine. Lead rougher.
17. MB-3008 Southwestern air flotation machine. Lead cleaner.
18. MB-3006 Southwestern air flotation machine. Lead re-cleaner.
19. Sumps.
20. 2-in. sand pumps.
21. No. 13 Wilfley pilot tables.
22. 6x6-ft. Southwestern conditioners.
23. MB-3012 Southwestern air flotation machines. Zinc rougher.
24. MB-3012 Southwestern air flotation machines. Zinc cleaner.
25. MB-3008 Southwestern air flotation machines. Zinc re-cleaner.
26. 10x8-ft. Dorr thickener.
27. 22x10-ft. Dorr thickener.
28. 2-in. Dorrco suction pumps.
29. 6-ft. diameter, 3-disk American filter.
30. Concentrate bins.
31. Tailing pond.
32. Recovery water pump.

operation. The lead and zinc concentrates are laundered to Dorr thickeners at the filter plant. Here a three-section American filter discharges zinc concentrates from two of the sections and lead concentrate from the third section direct to bins and thence to railroad cars. Air for the flotation machines is supplied by a 24-cu.ft. Connersville blower, operating at 350 r.p.m. All mill units are driven by electric motors operated through remote-control switches from a central operating platform. A 440-volt 125-hp. synchronous motor drives the ball mill, enabling it to maintain an operating power factor well above 90 per cent. The ball mill is direct-connected to this motor by means of a magnetic clutch. The other units are belt driven.

Flotation reagents used and the point of addition are as follows:

For the lead—Soda ash, zinc sulphate, sodium cyanide, and thiocarbanalid, added at the ball mill. Lead conditioners comprise Aërofloat and pine oil, added at the lead conditioner. The addition of soda ash is regulated to maintain an alkalinity of *pH* 7.6 to 7.8 in the lead heads.

For the zinc— Copper sulphate, xanthate, and Aërofloat are added at the conditioners, with a little sodium cyanide and lime direct to the recleaner. Sufficient lime is added here to maintain an alkalinity of *pH* 7.8 in the zinc heads. Adding the lime at the recleaner gives a *pH* in the recleaner circuit of 9.0 to 9.6. The zinc concentrates are thus separated from practically all of the free pyrite that may be floated ahead of this unit.

The soda ash, thiocarbanalid, and lime are fed by means of Southwestern dry reagent feeders. The oils and other reagents are fed from Southwestern solution and oil feeders. All solution and oil feeders are at the central operating platform, giving the mill operator control of his entire plant from this point. The operating force consists of one mill man, one helper per shift, with a crusherman on the day shift and a filter operator for two shifts.

Excellent recoveries are being made on both lead and zinc, with a high-grade lead concentrate and an exceptionally high-grade zinc concentrate for this type of ore.

Characteristic results from the mill operation on an average daily tonnage of 98.99 are as follows:

Assays

	Ag, Oz.	Pb, Per Cent	Cu, Per Cent	Zn, Per Cent
Heads	2.37	2.04	0.44	12.04
Lead Conc.	50.99	47.87	4.66	18.24
Zinc Conc.	1.85	0.95	....	56.85
Tailings	0.18	0.17	0.06	1.28

Recoveries

Ag, Per Cent	Pb, Per Cent	Zn, Per Cent
79.76	84.24	86.14

I. H. Stanley is mill superintendent, and J. H. Bell is superintendent of mine operations.

The Tendency in Power Application

MANUFACTURING plants in the United States use about 50 times as much electric power equipment as they did in 1900. Electric motors in factories in 1925 absorbed 26,123,573 hp., as against 492,936 hp. in 1899. The 492,936 hp. of electric motors in 1899 constituted only 4.9 per cent of the total of installed power; the 26,123,573 hp. aggregate of electric motors in 1925 represented 73 per cent of all installed power, and indications are that this growth is continuing.

Subsidence at Miami

THE first stage of surface subsidence, caused by removal of ore beneath, at the Miami Copper Company's property, Miami, Ariz., is shown in the oval. The draw points are approximately 600 ft. below the surface in both photographs. In back of the ridge in the foreground of the lower view is the cave that was caused by mining the old high-grade orebody, which operation ceased some years ago. The dark material in the foreground is a red oxidized schist capping; the lighter material in the background is Gila conglomerate. No. 4 and 5 shafts are visible to the top and left of the lower illustration.

To Secure Industrial Peace . . .

Managerial Efficiency *in*

Must Be Developed to Abolish Class Consciousness and

At a luncheon of the American Committee of the Geneva Institute of International Relations, at Geneva, Mr. Sam A. Lewisohn, chairman of the board of directors of the American Management Association, and vice-president and treasurer of the Miami Copper Company, spoke to Europe of America's aims and policies in its efforts to attain industrial peace. "Engineering and Mining Journal" believes that this message should be read in every one of the sixty-four countries in which it circulates. If what Mr. Lewisohn says be taken to heart and acted upon, one may confidently expect an extension to many other countries of the prosperity that is so characteristic a feature of industrial enterprise in the United States.

THE psychological background of the industrial situation, both in Europe and America, may well be likened to, say, the situation in a primitive family in a sparse country where a bare living has been scraped for the whole family with the greatest difficulty. During this period of economic destitution and difficulty, the older brothers of an earlier generation mistreated and exploited their younger brothers.

As a result, the younger brothers indulged in fantasies of revenge, and, conversely, the older brothers were overcome by a sense of guilt and fear of their younger brothers. A new generation is born, and meanwhile the family has discovered a new method of creating sufficient wealth for the needs of all. This method, however, is dependent upon the older brothers securing the co-operation of their younger brethren in effective teamwork.

Unfortunately, the psychological situation created in the earlier period has become a tradition which is handed down to the later generation. It has become an *idée fixe* —a religion on the part of both groups. Their minds in this direction become impenetrable to the facts of the newer realities. Indeed, the younger brothers rather enjoy this emotional debauch, and on the other side the older brothers, instead of trying to break down this heritage of suspicion, hug to their bosoms the feeling of fear of what "Labor" may do to them, and neglect the perfecting of methods of securing maximum production. This, I think, gives a fair picture of the background of the psychology of workers and employers in America and Europe. Of course, as an older civilization, you suffer from this state of mind even more intensely than we do.

The result has been too often that production has proceeded in our factory as if it were conducted by two embattled armies who had declared a temporary armistice. All relations between the two armies are conducted with the self-consciousness of combatants holding each other at arm's length. A set of elaborate rules governing mutual relations are instituted. The factory has been turned into a courthouse. Too often industrial relations have been treated as if the attempt was being made to run family life through a domestic relations court, forgetting that you cannot insure conjugal affection by laws.

Suppose social workers were to attempt to solve the problems of family life by evolving a plan whereby all the wives were organized into one association and all the husbands into another, or, to make the analogy closer, all the parents into one group and all the children into another, and then meetings were held by duly elected representatives of each group to discuss their mutual rights and duties. Finally, suppose elaborate resolutions were passed promising to co-operate and it was provided that any differences in any one family or between larger groups of families were to be left to a court of arbitration or a board of conciliation, and rules were set up providing regulations in regard to the conduct of family life. The analogy may perhaps be strained, but I do not think it gives an entirely unfair picture of the principal methods pursued in the past for solving labor problems. Of course, as an officer of the American Association for Labor Legislation, I do not in the least mean to underestimate the usefulness of rules to protect the younger brother of my first parable. They were, and still are, very necessary to protect him from being so abused as to lead to the collapse of our social system.

I think that the economist must be held partly responsible for crystallizing this state of mind—this class consciousness—for he has created such abstractions as "The Economic Man" and "Capital and Labor"—terms which, like all abstractions, are only partly true. There is one broad principle that some of us employers in America and many European employers are coming to recognize, and that is that in the operation of manufacturing industries there is not only an *economic* side, but also an *administrative* side. In practice, the two aspects may, to a large extent, be intertwined, but it is well for straight thinkers to recognize these two strands in the thread of our industrial relations.

In addition to "The Economic Man" of the economists

in Its Broadest Sense . . .

and to Encourage Interdepartmental Co-operation

—that is, man struggling for his share of what is produced—there is in industry "The Administrative Man," who is a unit in a complicated organization, trying to achieve results in turning out productive goods. An industrial organization, as an administrative problem, is not very different from such organizations as a Red Cross organization, a consumers' co-operative organization, or a post office, all of which are also trying to achieve results in providing services of one sort or other, but in which no question of capital and labor is involved. To get away from such abstract terms as "The Economic Man" and "The Administrative Man," and to be concrete, an example from everyday industrial life will possibly help.

SAM A. LEWISOHN

We often hear it said by the unthinking that the only problem in which the worker is interested is wages—that there is nothing else to the labor problem. Yet we see again and again examples of two factories existing side by side in the same vicinity, paying exactly the same wages, one of which has a contented, happy working force, the other of which has a dissatisfied, restless group of employees. Here we have, in a rough way, a controlled experiment, and in each case, when we look for the factor that causes this difference in results, we find it in the difference in method in which the administrative problems are handled in the aforementioned factories. We are apt to find in the one case the problems of employee relations were handled skilfully; in the other awkwardly.

I am not speaking entirely about imaginary cases, but, to a large extent, from experience. In plants under my own control there have been successive managers who secured quite different results in the spirit prevailing in the factory, and thus in the productive results. In each case the diversity in the psychic and productive results was due to the unequal degrees of thoroughness and skill with which the respective managers went about attacking their personnel problems. To use a more homely illustration, we know of housewives who pay exactly the same wages to their servants, but who get startlingly different results in service and goodwill.

Despite such plain evidence of the importance of the administrative aspects of the labor problem, there has been a tacit assumption in almost all quarters that the labor problem is purely an economic problem, and that anything that is done in the way of developing a better technique is, in fact, purely an effort to palliate the underlying economic injustices—that anything an employer does to improve his employees' relations is done with "his tongue in his cheek."

Of course, it cannot be denied that, as before said, the administrative and economic phases are somewhat entangled. This entanglement is very real despite the fact that the actual conflict takes place outside the factory. For it should be kept in mind that the determination of real wages takes place, as J. A. Hobson, of England, and many others have pointed out, for the most part not within but without the factory walls in the competition between industries, in the field of taxation, and so forth. Sometimes the inequalities between groups are due to the vagaries of our credit and monetary systems. Of course, the contest for the economic surplus is not solely, or even for the most part, between so-called "Capital" and "Labor," but between various other groups. Agricultural workers are pitched against industrial workers, employers and employees in one industry contend against employers and employees in another industry.

Thus the economic struggle may, in fact, be between

one group of older and younger brothers against another group of older and younger brothers. At times it may be vertical and not horizontal.

In any event, the struggle as to which group is to get the cream of our national income for the most part takes place outside the factory. Though there is room for bargaining and discretion within certain limits, outside forces which they cannot control set definite limits within which the individual employer, or even the individual industry, must remain.

Yet, despite the fact that the main struggle for each nation's surplus takes place outside the factory, social injustice is done, and as a consequence the worker, the younger brother of our parable, necessarily displaces, as psychologists say, his emotional bitterness against the world in general (his social grouch) by expressing it in the irritability he evidences in his daily factory relationships. He is not interested in the fact that the injustices are not due to his particular employer or even to employers in general. He rationalizes his social antagonism by finding something to complain of in his relations with his foreman and his work. The sense of injustice caused by the inequalities created outside the factory seeps into the factory, which happens to be the meeting place of two very large groups. Thus there is a real economic basis, as well as a traditional basis, to the class consciousness of the worker.

Now, some of us American employers have felt that it is bad enough that the social bitterness of the worker should complicate the administrative problems of securing production, but that it is doubly unfortunate when, as is too often the case, this class feeling, both economic and social, should control the conduct, not only of the subordinates but also of employers and executives, and render them emotionally unfit to lead and organize their employees. They have felt that it is rather the responsibility of the older brother, and not of the younger brother, to break the vicious circle of events that has created antagonism. The basis of this feeling is that as the responsible organizers of factory life, and the influential factors in industry, employers have the responsibility of bringing about an improved attitude. They have recognized that it is a rare opportunity for achievement, because, by overcoming these difficulties, sufficient production can be secured for all. So they have attempted to overcome this complication of class consciousness and deliberately to go about solving the matter of securing the goodwill of their workers, just as they would go about solving any other problem of securing productive results.

They have gone about perfecting the technique of securing goodwill just as, say, a travel bureau would go about perfecting the technique of the travel service or a hotel of its services. The employee is regarded as a bewildered traveler who must be taken care of. An attempt is made to treat the workmen with some semblance of courtesy. An example of the technique of securing goodwill is the practice in some organizations of having the employment department see that a newcomer is introduced to his fellow workers.

In America we have a rather naïve idea that any problem can be solved, from eliminating tuberculosis to selling automobiles, by organization, by ingenuity and technique. America has turned toward the Conquest of Organization. We have almost a religious passion for organization, not only in industry but in every field.

As a consequence of this self-conscious attempt to organize the personnel of industry, a literature of personnel administration has grown up. The result may be that in these matters some of our companies have gone to extremes, and there has been over-organization, but from a broad point of view I feel that the development has been a healthy one. For it has led to the subject being regarded objectively instead of subjectively.

It has been possible by this means to bypass the class bitterness that traditionally adheres to these relations. As a matter of fact, the technique of personnel organization has included not only the rank and file of workers, the so-called labor group, but also executives from the top down. So that, to this degree the whole theory of class division has broken down. Outside the field of industrial organization an attempt has been made to develop a parallel technique in the field of government.

In organizing these personnel matters, the general attempt has been to achieve a sort of teamwork in the individual factory, and to bring this about the attempt has been made to satisfy the desires of employees within the limits of the requirements of productive efficiency—and, in fact, to see how productive efficiency could be furthered by this satisfaction of working aspirations.

Just for the sake of having some framework, I have roughly classified these desires into the desire for justice, for status, and for opportunity.

Justice is, of course, just an elemental idea of fair play. I am leaving aside the matter of wages, as this is the economic side of the problem; as I have pointed out, there are definite limits within which even the most liberal employer is confined in paying real wages. I am rather referring to the sort of justice which should inhere in the daily relations between executives and their subordinates. Let me give an instance:

In a mine with which I am acquainted there fortunately exists an excellent morale. The following examples of the policy pursued explain why a favorable situation exists. The superintendent of one of the departments, a valuable but excitable man, was angry with a workman over a mistake that he had made. In his excitement he grasped the workman by the arm. The latter misunderstood. A rough-and-tumble fight occurred. The manager of the mine suspended the offending superintendent, and, in spite of the willingness of the workman to drop the incident, insisted on a formal apology. In another mine, a subordinate department head discharged an engineer who had wrecked an important machine by careless manipulation. In replacing this man, he skipped the brother of the discharged engineer, who was next in line for promotion. It looked as if the executive was punishing the man for the faults of his brother. It appeared certain that this step would create a great deal of resentment. The manager promptly overruled the act of his assistant, risking the loss of a valuable executive member of his staff in so doing. It is this sort of fairness that is fundamental to and basic in any sound administrative system.

Here, you may say, is a matter which has nothing to do with technique, but which depends solely upon the innate breeding of the man in charge. But I have seen radical changes occur even with men of naturally good instincts for leadership when they were properly trained. Otherwise executives too often forget their intuitive talent for leadership, and become absorbed in purely mechanical and financial problems. It is for this reason that in America we have gone in for courses of foremen training. The Federal Board for Vocational Education,

a governmental institution, has given demonstration courses in many factories.

Then we come to the subject of status. Here the technique that is being developed is that of the works councils or employee representation, as they call it in America. These vary from informal committees, to which a manager explains his plans, and committees which have purely advisory functions, to committees to which it has been attempted to give definite powers. I am one of those who have always regarded the function of the works council to be entirely advisory and consultative, its main purpose being to give the workers a feeling that they, the workers, have been consulted. It is, of course, nonsense to think that industry can be successfully run on anything approaching the parliamentary system. Generally speaking, the works councils enable the management to interpret itself to the men, and the men to interpret their aspirations to the management. There are those who have interpreted the works council as a hypocritical device of management to avoid economic pressure. This, I think, is a very shallow interpretation. It is not merely an economic means of escape, but a sound administrative device similar to that used in other fields. It serves as a vehicle for laying the facts of the business before the workmen, and thus gives each workman the feeling that he is being consulted, and enables the management to utilize the practical knowledge and experience of its employees.

The important fact about this development in America is that it has proceeded from the initiative of the employer as the directing mind, and has not been imposed upon him by law. Indeed, the whole theory of the attitude in America has been to avoid antagonizing employer or workmen by too many rules, but to awaken their constructive instincts as leaders and collaborators. In America we try to do things through enlisting the interest of those in the organization rather than by autocratic orders. For example, in one of my establishments the manager was interested in getting the men to pay more attention to the principle of "safety first." Instead of relying entirely upon set rules, he found the most effective result was secured by having the whistle blow every day when there was no accident. The men became keenly interested, listened each day for the whistle to blow, and were very much disappointed when it did not. As a result, the accident rate dropped perceptibly. This is in accord with the tendency in America to invoke the game spirit—a very useful "non-financial incentive." In some factories this spirit is utilized by forming teams to compete against each other in making records in securing certain types of results.

Thus, we come to the desire of the workmen for opportunity. Workmen who are energetic desire a successful career. Of course, in America, with our tradition of "jack of all trades" (which we carry perhaps too far), with our idea that every bright young man can adjust himself to almost any technique, we have gone much further than any other country in trying to make use of promising material in the ranks. Therefore, a great deal of time and effort has been spent in systems of training and methods of awarding promotion to the able man. Of course, in America these training systems are particularly important, because of the breakdown of the apprentice system.

Now, in order to secure justice, status, and opportunity, it is necessary, of course, to have adequate and systematic methods to carry these abstract ideas into effect. Of course, it is not necessary, in Geneva, to emphasize that abstract goodwill is not sufficient, and that you must have machinery to carry it into effect. So in America a certain amount of personnel machinery is thought necessary under the newer program of industrial personnel organization. For example, there has been established in practically all the more forward-looking companies in America a personnel department, particularly necessary where large numbers of employees are regarded as prime requisites. As I have said, one of the principal functions, though not so important as in Europe, with its relatively stable population, is that it can prove most useful, particularly in large organizations, in making certain that each employee secures the opportunity of being transferred to a more promising position in another department if he is ambitious. It makes certain that the employees are handled with courtesy and given considerate attention and their day in court. Complaints can be handled in this way, the manager and the works council acting mainly as a court of appeals. Formerly, the theory was that any worker could see the manager. If the manager really took the time to hear all complaints, his valuable time was wasted, and he was forced to neglect more important duties. But, of course, it was just the able manager who found it often impossible to give the time to these matters. Thus, injustice was often done to the workman because of the inadequate provision for the specialization of this function. This was a case of lack of proper technique, causing failure in providing such abstractions as justice, status, and opportunity.

I have been much impressed, in plants under my own observation, by the ease and informality with which transfers were made for ambitious workmen by a properly organized personnel department. Such a department insures concrete justice by affording the worker a means of having his complaint heard with the minimum delay, and by taking the right of "firing," as well as the right of hiring, from the harsh, unjust foreman. There have been some misgivings as to whether discipline might not be impaired by such a system, and yet to my personal knowledge it has worked out successfully in many plants where it was previously thought impossible. Of course, in most places, such problems are not settled in a juridical fashion as matters of right or wrong, but as matters of adjustment. Often men who cannot get along with one foreman will be transferred to another foreman with whom they may be sympathetic, and the whole trend is to avoid turning the factory into a courthouse. Of course, there should be little real conflict of this character with a properly trained managerial staff. Indeed, many of us in America regard as the prerequisite of an adequate national industrial system a properly conducted executive group. After all, though I have discussed technique, the most important factor is the spirit with which this technique is administered.

Above all, a patriarchal patronizing spirit must be avoided. If we are to make any progress in solving the so-called labor problem, it is essential that the "older brother," at least, be free from any traditional class feeling, and have an appreciation of his responsibilities as an industrial leader. It is unfortunate enough, as I have pointed out, that the social bitterness of the workmen should complicate the administrative problems of securing production. But, as I have said, it is doubly unfortunate when the class feeling of the employing class (the "elder brother") renders the executives of this class emotionally unfit to lead men. That is the reason why

many of us in America feel that one of the most important steps in solving our industrial problem is what we call "The Education of the Employer." We feel that it is essential that means may be provided of making certain that those who by any chance may in later life become industrial executives have an adequate appreciation of the importance of the technique of personnel administration. They should also, of course, have a sufficient knowledge of the background of the whole industrial problem to be free from class consciousness. Some of us have, for this reason, been interested in making certain that courses are provided for those who may become industrial managers, so that they may have an adequate understanding of the emotional and administrative requirements of their positions. We regard it as particularly important that such courses be included in the curricula of technical and engineering schools, as engineering graduates so often become managerial executives.

In addition, for the benefit of business men in active life, we have organized such associations as the American Management Association, composed of 402 companies and 4,327 individual members, in which executives compare experiences in detail in these and other managerial matters. We feel that to insure a healthy industrial situation in the future we must get inside the business mind. Of course, in Europe with the system of trade unionism, it is necessary to secure the co-operation of the union leaders to any program which is outlined above, but we have instances in America of management-union co-operation, and such co-operation is dependent in the first instance largely upon the farsightedness of the executives who are in charge of these particular industries.

I have only dealt with one aspect of labor administration. Experience in our country has made apparent something which was not appreciated by those who had seen the problem solely from a sentimental point of view —who regarded the labor problem solely as a matter of abstract social justice. This is the close relation between industrial peace and managerial efficiency. For example, in many plants dissatisfaction is created because of inadequate routing of material. Piece-workers often complain bitterly because poor routing gives some workmen advantages over others in getting material, and in addition much time is lost by those who have to wait in idleness for work. In fact, the attempt to keep the waiting idle workers from leaving the building has led to disciplinary problems in many cases.

Then, too, there is the matter of securing co-operation between different departments and executives, for the purpose of achieving teamwork on the part of all members of the organization. One problem that is being worked out in America is to prevent irregular work in the factory—that is, to curb the "single-track" point of view of the sales department. One can expand the list of inefficiencies almost indefinitely, and show how these generate a "labor problem."

So we come to the problem that you are soon to discuss: the whole subject of the elimination of waste, and more methodical and systematic management. But in the consideration of these subjects I hope you won't omit to discuss what may at first glance appear a narrower subject. These details of labor administration to which I have alluded may not seem important when considered one by one, but if you are to develop a morale in your working force, this technique of goodwill must be worked out; and remember it is not aways the largest part of the machine that causes the most trouble. It is also essential to perfect the ball bearings, though they may appear as infinitesimal in size as compared with the whole machine. For if they are faulty they cause friction, and the condition wrecks the entire machine. In any event, in all these matters it is the employing group, the older brother in industry, that must lead the way to industrial peace.

Metal Coating as a Protection Against Corrosion

IN metal-spraying processes in use at present, a wire of the metal is melted by an oxy-hydrogen flame, and simultaneously sprayed by means of compressed air, the dispersed metal forming a deposit on the object to be treated. According to R. Hopfer ("Die chemische Fabrik," May 30), the weight of metal which can be dispersed in this way by a single unit varies from 6 kg. per hour in the case of lead and tin to 700 grams per hour for aluminum, states *Chemistry and Industry*. For iron, copper, and bronze the quantity is 1 kg. per hour. The metal surface to be coated must first be rendered rough with a sand blast to insure adhesion. Coatings of any desired thickness greater than 0.02 mm. may be prepared, but for rust protection 0.05 mm. generally suffices. All metals which can be prepared in the form of wire and which melt below 1,600 deg. may be so dispersed, though the porosity of the deposit renders the process unsuitable in some cases. In coating iron with aluminum, this porosity is eliminated by subsequent heat treatment to 400-1,000 deg., alloys being formed in increasing amounts at the higher temperatures. Iron treated in this way is specially resistant to the action of hot oxidizing gases up to 1,000 deg. Iron coated with aluminum and zinc and then subjected to moderate heat treatment resists corrosion by sulphur dioxide.

Greater Contentment at Smaller Cost

SAFETY and economy are both desirable ends, but usually a choice between the two is necessary. Recent bunk-house fires in which lives have been lost have called attention to the necessity for the adaption of a safer type of construction. To most operators this would imply more expensive construction as well. However, at the Paymaster mine, in the Porcupine district of northern Ontario, new designs for wood-frame structures were used in erecting bunk houses that rendered them fireproof and at the same time cheaper than the usual frame building. In addition, this construction has the advantage of being heat insulated. Mr. H. E. Clement and Mr. James Govan discuss the subject of economical and efficient housing in a series of articles to appear in forthcoming issues.

Can Pulp Thickening Be Simplified?

By E. G. Howe
Etzatlan, Jalisco, Mexico

MANY developments have been reported recently in connection with the thickening of slime and the dewatering of large volumes of tailing. Such installations as the 325-ft. thickener recently completed by Miami Copper and those at the Warren and New Cornelia concentrators show the broad leanings of present-day metallurgical practice, in which everything trends to greater tonnage at lower costs. Heretofore, the problem of increased tonnage has been merely a matter of adding additional units, but now a single unit may range from a capacity of five tons in the laboratory machine to a device with a diameter of 325 ft. and designed for the dewatering of 18,000 tons of flotation tailings daily.

At Ajo, Ariz., H. Kenyon Burch, the designer of the plant, provided for the removal of the coarsest material in a tank 20x60 ft. in plan, having a sloping bottom equipped with classifying cones. Overflow from this tank constitutes the feed to the thickener. As this unit is handling in excess of 6,000 tons, minus the sand removed by the cones, it provides an area of about 6 sq.ft. per ton per 24 hours.

Calculating on a probable removal of 20 per cent of the solids before delivery of the pulp to Miami's thickener, the area is found to correspond closely to that of the New Cornelia unit.

Area is the dominant factor in pulp thickening, and it varies according to the class of material, density of feed to thickeners, flocculating agents used, temperature, and numerous other factors to be determined by experimentation. Quoting Taggart: "Area required varies from 2½ to 20 sq.ft. for extremes in both cases, with an average of about 8½ ft." The construction costs of a plant permitting the smaller area would be much lower than one having a tendency to the other extreme. Where protection from freezing is needed, and where heavy rainfall would hinder the control of solutions in a cyanide plant—conditions demanding heating in one instance and roofing in the other—the difference in cost will be a matter of moment.

In recognition of the need for a reduction in the area required, various machines have appeared on the market and have met with approval for use in operations where a pulp of high solid content is especially desirable. These machines combine the principle of compression with filtration; and, in one case, vacuum alone is utilized to draw the solids into a compact mass for discharge. They are all more or less intermittent in character. In one type the sand-bed filter bottom needs renewal at intervals, but as sand of the required size is not easily procurable, nor facilities for rapidly introducing it into the tank always of the best, the disturbance of the circuit may inhibit utilization. A probable increase in capacity per square foot of 100 per cent may offset these disadvantages.

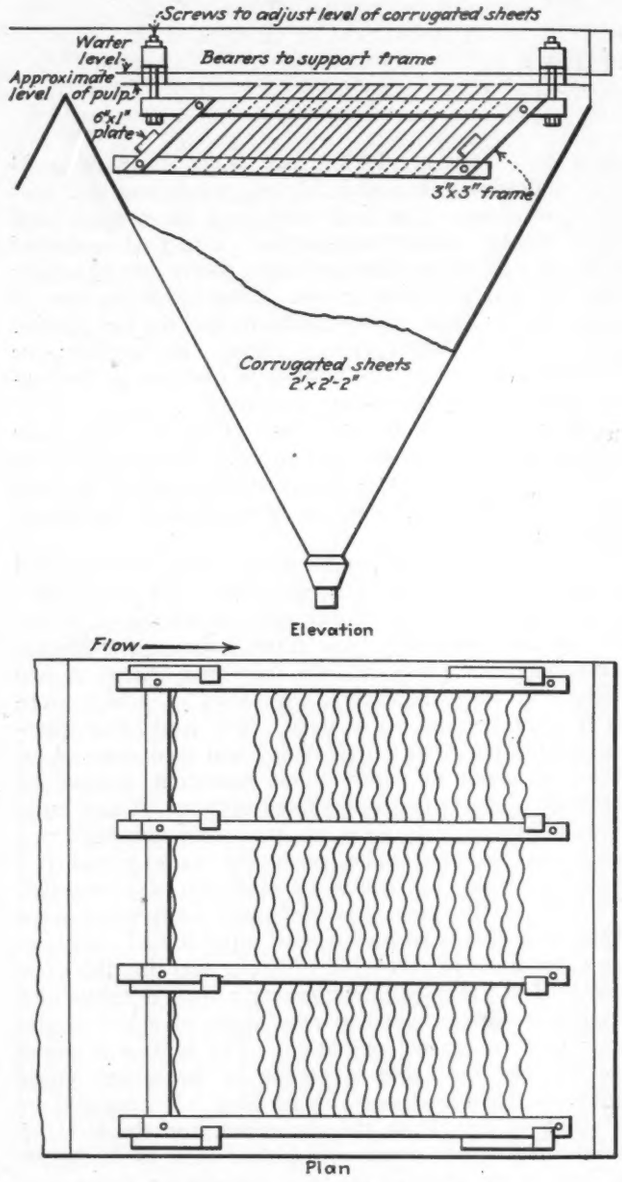
About thirteen years ago, at Homestake, 26-ft. conical-bottom tanks, 23 ft. 9 in. deep, treated 406 tons of slime pulp (sp. gr. 1.036) per 24 hours, making 84 tons underflow containing 33 tons solids and 322 tons clear overflow. The pulp contained no reagent, and water was at winter temperature. The feed contained 8 per cent solids; and the discharge, 39 per cent of solids; area, 16 sq.ft. per 24-hour ton. Considering the lack of a flocculation agent, the temperature, and the low specific gravity of the pulp (primary slime), this performance compares favorably with rake-type mechanical thickeners operating under similar conditions.

Other examples of the use of cones for slime thickening can be given, and in each case the ratio of solids in the underflow to the superficial area of the tank gave a favorable comparison to mechanical thickeners operating in parallel.

The possibilities of conical tanks were demonstrated to me some time ago. The conditions were as follows: A cyanide pulp sizing 10 per cent on 100 mesh, at the rate of 225 tons daily, was filtered through a Merrill plate-and-frame press, and the cake was sluiced to two mechanical rake thickeners, the tanks of which were 30 ft. diameter and 10 ft. deep. The feed being intermittent the tanks were overloaded and then emptied, in cycles of about an hour. This condition resulted in breakage of parts and interrupted service. A day came when no spare parts were on hand, and one tank was down for repairs. The remaining tank would not handle the feed, but continued operation was essential. The use of the tank was continued until parts were available, in the hope that at least a portion of the sluicing water could be recovered. To our surprise, this tank continued in use indefinitely, giving a clear overflow and a spigot discharge equal in percentage of solids to the other tank in normal operation. The tank was never emptied, and the angle of repose of the settled solids could be determined only by probing. It appeared to be about 43 deg. from the horizontal, and the level of the sand in repose never rose higher than 18 in. below the level of the water in the tank, thereby signifying that all solids settled out within a circle, the radius of which was 10 ft. Thus a simple cone, 20 ft. diameter by 8½ ft. deep, thickened 112 tons per 24 hours, with a spigot discharge estimated at 45 per cent solids (average), and a superficial area of only 2.8 sq.ft. per 24-hour ton. In the *Journal* of the Chamber of Mines of Western Australia, about 1910, an article appeared by B. L. Gardiner, entitled "Slime Settlement." In this paper, Mr. Gardiner gave the results of experiments to reduce the area of spitzkasten then in use to settle the slime of the cyanide plant at the Sons of Gwalia mine. The ore was schistose in character and slow settling. After the removal of the sand in primary spitzkasten, the pulp, at a dilution of 17 per cent dry slime, was delivered in equal portions to two parallel spitzkasten of an area of 192 sq.ft. each. In one spitzkasten a nest of baffles, consisting of sheets of corrugated iron roofing, were hung at an angle of 45 deg., the tops being a few inches below

the surface and the sheets extending downward about one-third of the depth of the tank. Details are shown in the accompanying sketch, in plan and elevation.

The principle involved is demonstrated by filling two



Gardiner system of slime settlement

glass cylinders with pulp and allowing them to settle, one perpendicularly and the other at an angle of 45 deg. The material in the inclined cylinder will settle to the compacting zone at a rate four times as fast as the one in the vertical position. Noting the counter-current action of the slime and water, one can readily understand the advantage of the baffles. The corrugations serve to gather the upward flow of water into small streams, which affect the natural surface area only slightly in breaking through. This creates a true free-settling condition, in which the falling particles are not hindered by a rising current of water.

The feed to each of these spitzkasten being 36 tons per 24 hours, the area provided was 5.33 sq.ft. per ton. The tank equipped with the accelerating device gave an underflow at 41 per cent solids, against 26 per cent for the other. This overflow was clear at all times. Mr. Gardiner states that the device can be used to increase the amount settled or to decrease the percentage of water in the underflow, as conditions demand.

The efficiency of the altered spitzkasten did not increase in proportion to the increase in the effective area produced by the baffles, owing to the greater density at the lower extremities of the sheets and to the disturbance that was caused by the uprising streams of water on the surface.

Experimental work was performed by Anaconda engineers along these lines in the same year. A rectangular tank, 3 ft. wide by 3 ft. deep and 9 ft. long, was equipped with baffles as before described and fed with a dilute pulp at varying rates. Comparing two tanks, one equipped with the baffles and one open, both overflowing slime, the baffled tank settled from 30 to 66 per cent more solids than the other, the amount increasing with the rate of feed. This tank was fed at one end and discharged at the other, and could be more aptly called a classifier than a thickener, as the rush of pulp over a confined area would not be inducive to effective settling. When a high removal of solids was desired, choice could be made between the two tanks, but, with less complete solid removal, the capacity was remarkably greater in the baffled tank.

Considering the Sons of Gwalia and the Anaconda experiments, one sees that the pulp handled was of the most difficult type to thicken, it being the finest colloidal product resulting from fine grinding of ore for all-slime cyanide treatment in one case, and, in the other, primary slime from an ore prepared for gravity concentration.

Since the introduction of flotation, a great number of plants have adopted comparatively coarse grinding. In the disposal of tailing from a flotation plant grinding to minus 48 mesh with about 50 per cent minus 200 mesh, opportunity offers for the development of some type of non-mechanical thickener that would give a good recovery of water on a pulp containing about 25 per cent solids and a high content of free-settling crystalline matter. This would involve the ready discharge of the sand, and an area sufficient to settle the inevitable primary slime. Where classifier overflow is too dilute for flotation feed, a device of this type would be suitable for making the slight increase in density needed. The application of inclined corrugated baffles to a tank of the spitzkasten type would apparently provide a greater effective area for the settlement of the slime, and, at the same time, discharge the sand by gravity. The advantage of a non-mechanical thickener is apparent in milling plants where power interruptions are of frequent occurrence. Most thickeners are isolated to some extent, so that plants powered by steam or oil engine with belt transmission would find difficulty in the utilization of a mechanical thickener.

Assuming a tank 30x30 ft. square and 20 ft. deep, equipped with 55 baffles, 6 ft. long, the total area of the baffles will be 9,240 sq.ft. Being inclined at 45 deg., the theoretical effective area is 6,468 sq.ft. However, the experiments in Australia and at Anaconda on colloidal slime show an average increase of efficiency of 44 per cent. Disregarding the probable greater increase on the flotation pulp in discussion, and calculating on the basis of 44 per cent of the 900 sq.ft. superficial area of the tank, the total effective area is 1,296 sq.ft. A query as to probable capacity on a flotation pulp must be left unanswered until further work on a product of this size has been done.

No difficulties should be encountered in the design and erection of a tank of this type. As the lower 10 ft. would be of small volume, and as the wall of that portion would be subject to the abrasive action of the sand, it would seem most economical to excavate and line with concrete, delivering the underflow to a tunnel with egress to the next bench. The upper structure could be built of concrete, masonry or sheet steel. Suspending the baffles from a truss over the tank would seem most feasible. A diaphragm of the Caldecott type for the apex of the tank would be indicated, and a pump or automatic density valve at the discharge would provide a uniform underflow.

The angle of repose of any specified pulp could be determined. On the rectangular spitzkasten type of tank in question, 30 ft. square and 20 ft. deep, side and corner angle would be 52 deg. and 44 deg., respectively. Professor Richards states that 45 deg. is permissible, but that 50 deg. is desirable, his calculations being for a conical tank used for classifying where a uniform underflow by gravity was desired and the disturbance of the circuit caused by a sudden surge of pulp was not allowable. The introduction of the diaphragm cone post-dated this statement. Advantage might result by designing the feed and overflow sides with unequal angles, the greater inclination on the feed side where the coarser particles fall, and the lesser angle opposite, where the repose angle would be less acute, owing to the fluid state of true slime pulp.

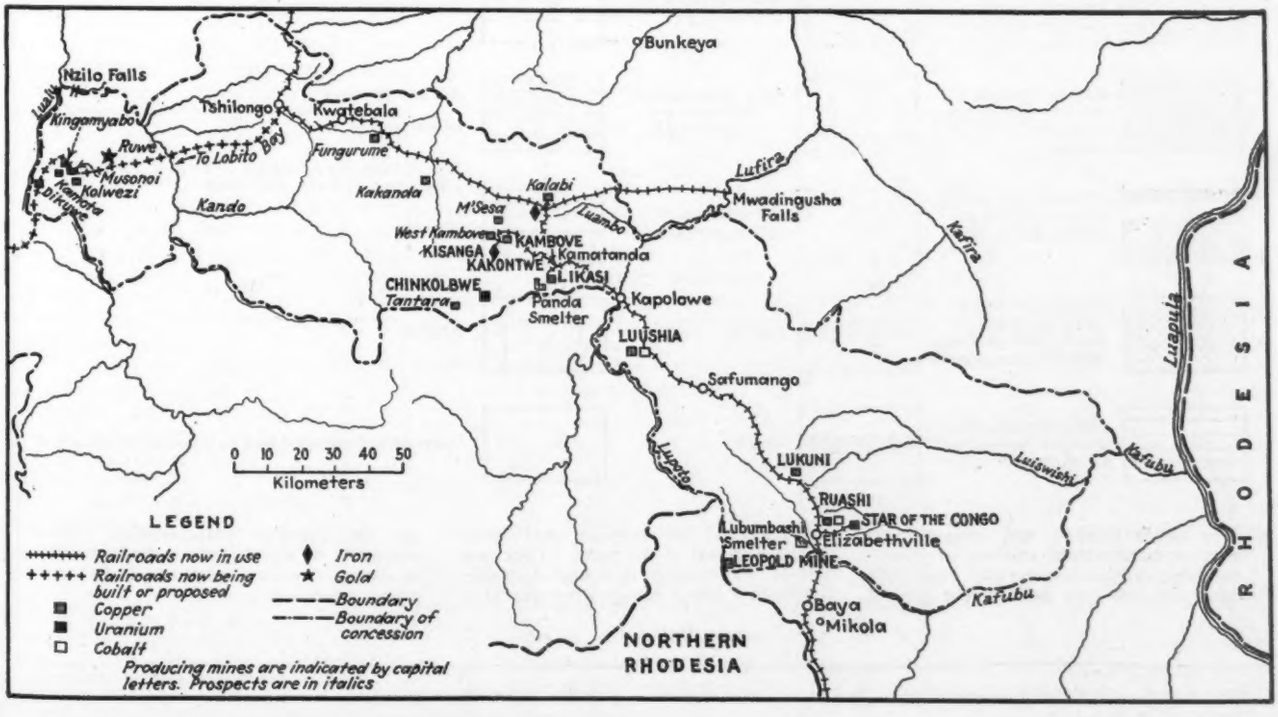
The Gardiner and Anaconda experiments showed that the position of the baffles, either crosswise or parallel to the current, caused no marked difference in results. I believe that the placing of the baffles crosswise to the current would prevent the inherent tendency of a surface current tank to form eddies detrimental to free settlement. The tank would be fed through a distributing launder at one side, and clear solution overflowed at the other. A classifying action will result as the pulp progresses across the tank, the heaviest particles falling first, with diminishing sizes dropping until all matter in suspension has settled. The velocity of the rising current is in direct proportion to the volume of the falling particles. The streams of upflowing water delivered by the corrugations will be greatest on the feed side, holding the lighter matter in teeter, until the surface current carries it on to a quiet area, where a smaller volume is settling and less disturbance is caused by the streams on the surface.

To attain the full effective settling area of the baffles, the level of the settled pulp in the compacting zone should be held just below the lower extremities of the corrugated sheets. The conditions in the compacting zone would be similar to the action in any conical tank or spitzkasten, wherein the solids move down the sloping sides and converge at the apex, the displacing of the water being upward in the center where a zone of lesser density is found.

The disadvantage of a spitzkasten or conical tank of large superficial area lies in the loss of head due to the depth needed to attain the proper angle for the gravity discharge of the solids. A diaphragm pump would serve the dual purpose of delivering a uniform underflow at the original level of the feed. In a square tank, the ratio of settling area to ground is 100 per cent, whereas in the round tank the loss in the corners reduces the ratio to 78 per cent, thereby increasing the cost of excavation for benches, construction of mill buildings and piping.

In the final analysis, everything points to the adaptability of the baffled spitzkasten of large area to the thickening of flotation pulps, with debatable possibilities on cyanide slime and the need for a dense product. The application of such a tank to the thickening of flotation concentrate would be worthy of consideration. It will be a pleasure to hear, through these columns, from those readers who have had opportunity to observe experiments in similar work.

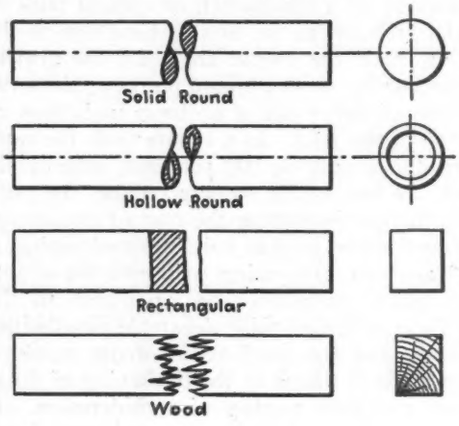
The Union Minière concession in the Belgian Congo, showing the western or Musonoi, group of mines, now being developed.

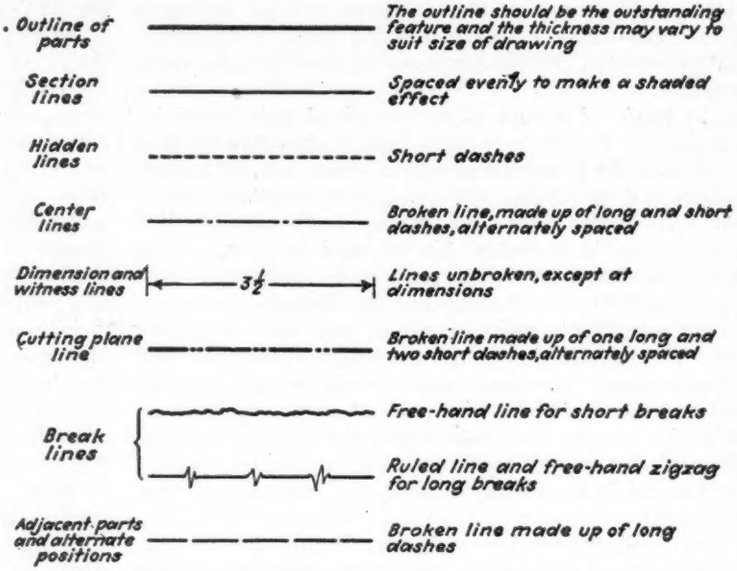


Drafting Standards for Line Work

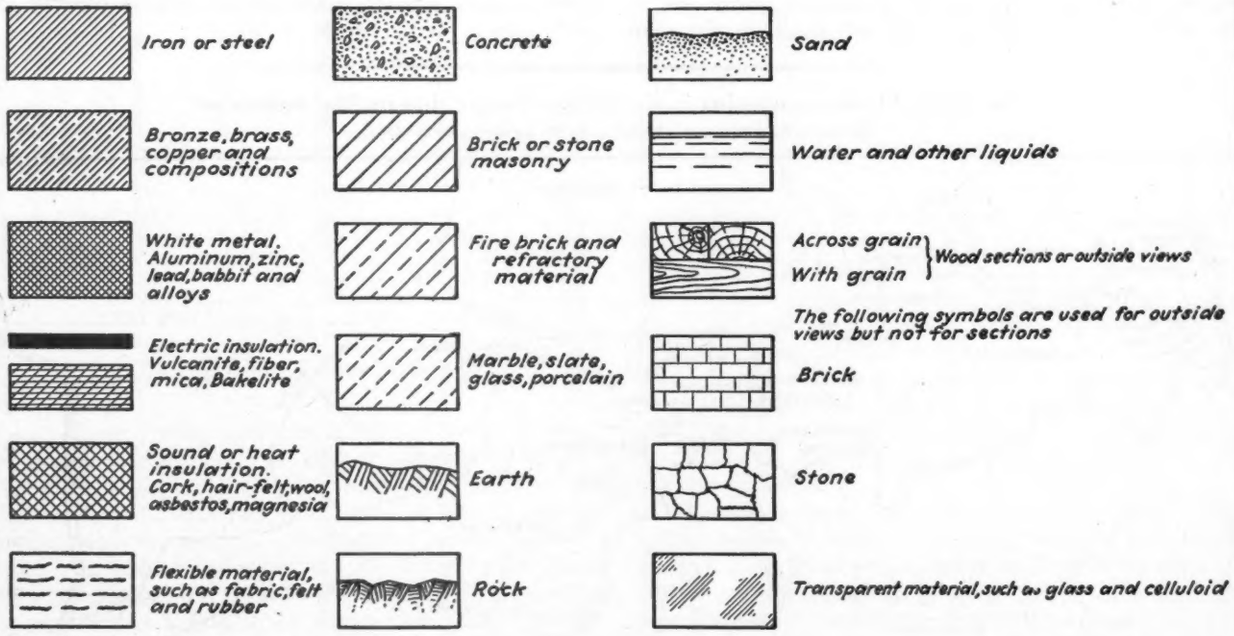
Proposed American Recommended Practice

The actual width of each type of line should be governed by the size of the drawing, the relative widths of the lines to be held approximately as shown to the right. Shafts, rods and tubes, which have a portion of the length broken out, are to be shown by the method given below using the following conventional methods of cross-sectioning for the broken portions




Outline of parts
The outline should be the outstanding feature and the thickness may vary to suit size of drawing
Section lines
Spaced evenly to make a shaded effect
Hidden lines
Short dashes
Center lines
Broken line, made up of long and short dashes, alternately spaced
Dimension and witness lines
3½
Lines unbroken, except at dimensions
Cutting plane line
Broken line made up of one long and two short dashes, alternately spaced
Break lines
Free-hand line for short breaks
Ruled line and free-hand zigzag for long breaks
Adjacent parts and alternate positions
Broken line made up of long dashes

All lines must be dense black to permit of reproduction of the drawing by the various processes. Witness and dimension lines are to be unbroken except by the dimension, and the arrows are to be closed, not open. Show as few "hidden lines" as possible, sections being preferable in many cases


Iron or steel
Concrete
Sand
Bronze, brass, copper and compositions
Brick or stone masonry
Water and other liquids
White metal, Aluminum, zinc, lead, babbit and alloys
Fire brick and refractory material
Across grain
With grain
Wood sections or outside views
Electric insulation. Vulcanite, fiber, mica, Bakelite
Marble, slate, glass, porcelain
The following symbols are used for outside views but not for sections
Brick
Sound or heat insulation. Cork, hair-felt, wool, asbestos, magnesia
Earth
Stone
Flexible material, such as fabric, felt and rubber
Rock
Transparent material, such as glass and celluloid

The above symbols and cross-sections give a conventional method of distinguishing various materials commonly used, but can only indicate the general character and not complete specification of the material of the parts. They permit of sub-division if found desirable, by making minor changes but maintaining the general characteristics. For simplicity on details where the material is named, sections may be shaded or made as for iron or steel

Courtesy of American Machinist

COST-CUTTING INNOVATIONS

ELECTRICAL — MECHANICAL — MAINTENANCE

EFFICIENT ROCK-DRILL FURNACE

Makes Cheap Local Fuel Available

BY JOHN B. HUTTL

Mine master mechanic, New York & Honduras Rosario Mining Company, San Juancito, Honduras, Central America

ALTHOUGH oil has taken the place of charcoal and other fuels used in furnaces for heating rock drills in some localities, owing to the high cost of transportation charcoal may still be the cheapest fuel for this purpose. This has been found to be so by the New York & Honduras Rosario Mining Company, at San Juancito, Honduras. At this company's property all material is brought in by oxcart or mule from the coast, and charcoal is obtained at 3.50 pesos (silver) per cargo of 200 lb. delivered at the bin.

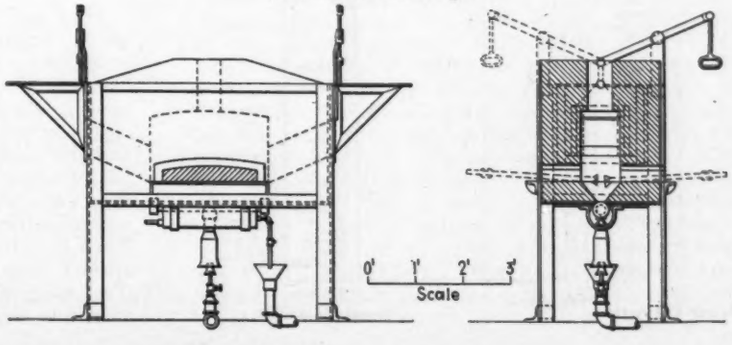
Recently a few changes were made at the drill-sharpening shop of the above-named company at Peña Blanca. In place of the old type of charcoal furnace, which had two openings—that is, two individual fires, the steel being inserted by two operators from the front and charged with shovels, to supply two Ingersoll-Rand drill sharpeners (Nos. 50 and 5) with hot drills—I have designed, built, and installed a new type of charcoal furnace which has given excellent results and which is 50 per cent more efficient than the old one. The furnace shell is made of 3- and 4-in. angle iron, ½x2-in. flat iron, and ⅛- and ¾-in. sheet iron, lined with refractory 9x4½x2½-in. bricks. To keep the two operators apart, the steel can now be inserted from both back and front, giving each man an individual furnace with one fire only. The sharpeners have also been placed nearer the furnace, increasing the production per day, as will be seen in the accompanying table. It is practically impossible to burn out the water-cooled air distributor with its ejector, built of 6-in., 3-in. and 2-in. standard pipe, arc-welded. On the old furnace this frequently burned out. The ejector, drawing in a large amount of atmospheric air and converting the high into low pressure, uses 40 per cent less compressed air than before and gives better combustion. The best results were obtained with 52 $\frac{5}{16}$-in. holes drilled in three rows. The distributor is held to the furnace bottom by two clamps, which can easily be taken off and a change made in a few minutes. By unscrewing the caps of the air pipe and water-pipe connections, the distributor can be cleaned without difficulty. To eliminate the crushing of coal on the floor, the furnace has been fitted with two coal hoppers, one on each side. The fuel to fill these is handed to each operator, as needed, in boxes containing approximately 11 lb. By opening the doors the coal is permitted to fall by gravity into the fire chamber. By moistening the coal and the doors occasionally with water, they will never reach a temperature high enough to ignite the fuel in the hoppers. Several tests were carefully made over a period of one week with the old and new charcoal furnaces, and also with a producer-gas furnace which is used for tempering the drills. Every pound of coal used was weighed on scales. The results obtained are given in the accompanying table. The data show that the new charcoal furnace consumed only one-half the amount of coal required by the old furnace—that is, 1,298 lb., as compared with 2,486—and that it used 64 lb., or approximately 5 per cent less than the gas-producer furnace. Moreover, it required 40 per cent less air than the old and permitted an increase in the number of drills sharpened from 6,759 to 7,299. A saving proportionate to the reduction in the amount of fuel and air required has also been effected by the new furnace. The cost for the week of operation under consideration was only 22.71 pesos as compared

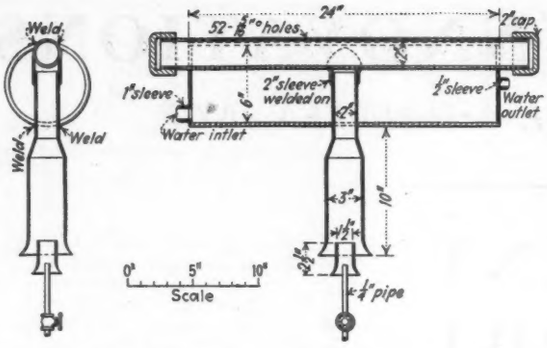
> Savings in twelve weeks are sufficient to pay for cost of new equipment

Results Obtained With Three Furnaces

Furnace	Date	Pounds of Coal Used per Week	Number of Drills Sharpened per Week	Cost in Pesos (Silver)
Old charcoal	Nov. 8-14	2,486	6,759	43.50
Gas	Nov. 8-14	1,364	6,759	23.87
New charcoal	Nov. 29-Dec. 5	1,298	7,299	22.71

Use of charcoal furnace for heating rock drills has resulted in a marked saving





Details of water-cooled air distributor and air ejector

with 43.50 for the old charcoal furnace and 23.87 for the gas furnace. Although it has been running only twelve weeks, it has already paid for itself.

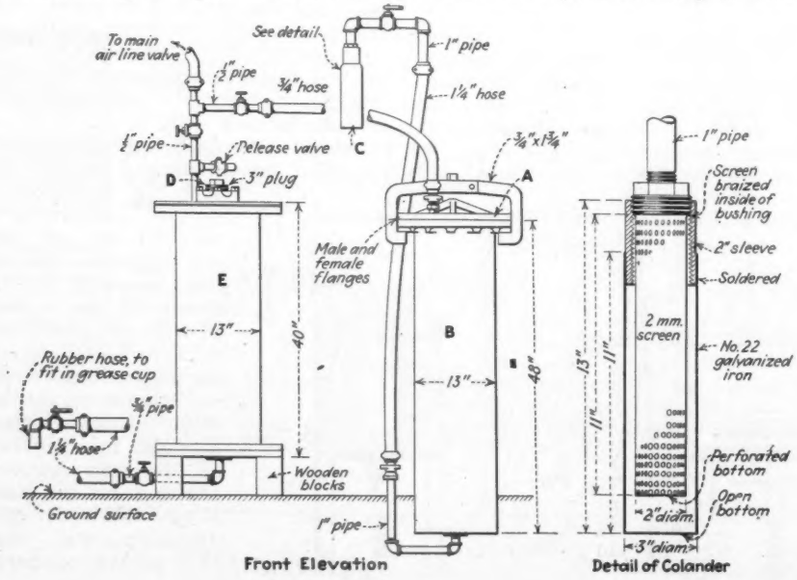
Grease Mixer and Gun Cuts Car Lubrication Cost

FOR low-speed bearings, such as those of mine-car axles, it is possible to use a cheap grade of lubricant. Although heavy crude oil is ordinarily used, it is not suitable, on account of its tendency to harden or gum. On the other hand, a liquid grease is too expensive to use in view of the great waste entailed in lubricating cars. Heavy crude oil and ordinary No. 3 cup grease, mixed in the proportion of three parts to two, made a good substitute for the expensive grease, thus reducing the cost of underground car lubrication.

At the Pilares mine of the Moctezuma Copper Company, a combination grease mixer and grease gun, shown in the accompanying drawing, has been devised by A. W. Sansburn, foreman of the mine blacksmith shop. The apparatus consists of a tank, *B*, of approximately 30-gal. capacity and fitted with a detachable lid, *A*, through which the mixture of oil and grease, which has previously been churned together by hand in the oil barrel until the grease has been broken up to a half-inch size, is introduced, and forced by means of air under pressure into a 1-in. pipe at the bottom of the tank, through a 2-mm. screen or colander, *C*. The colander insures a uniform mixture of the lubricants of the consistency of a liquid grease.

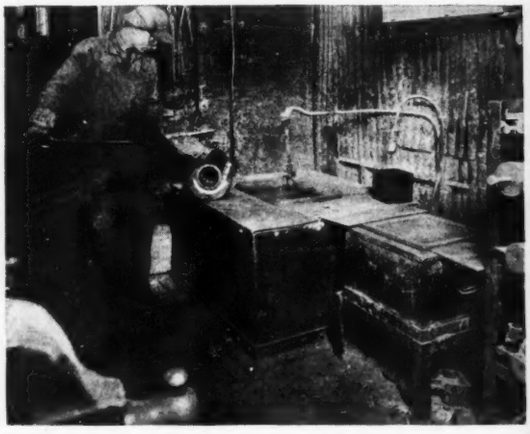
From the colander the mixture is forced through *D* into the grease gun, *E*. The latter consists of a tank 13 in. in diameter by 40 in. in length, the top of which is fitted with a pipe for the introduction of air. The grease from container *E* is forced through a ¾-in. pipe from the bottom of the tank through a rubber hose, *F*, to the lubricating cups of the mine cars, and the flow is continued until grease appears at the ends of the axle housings, assuring complete lubrication. Portable grease guns for the mine are also charged from tank *"E."*

Combination grease gun and mixer used at Pilares mine for lubricating mine cars



Home-made Babbitt Melter Effects Savings

A BABBITT-melting pot, cast at the Utah Copper Company's own foundry and costing considerably less than the amount for which it could be purchased, has demonstrated its superiority over a long period of time. It holds about 400 lb. of metal and is 14x14x6¼in. in size. It is made of ⅝-in. gray iron with the sides and bottoms recessed to receive the metal immersion units, leaving a flat bottom and sides for the metal.



At the right is seen the babbitt-melting pot designed and built by the Utah Copper Company for its own use

Automatic temperature controls maintain within 10 deg. a constant heat varying from 700 to 1,000 deg. F. Five General Electric 1½-kw. metal immersion units with the heaters inside fit into the recesses, three on one side and two on the other.

A sheet steel cover ⅛ in. thick and its supporting frame, welded together with insulation around the pot, is fastened down with four screws. Casting of the babbitt pots has been done with such skill and strains are so evenly distributed that no trouble is had with the cracking of heat-unit recesses.

Economy in Pump Repairs

Time and money were saved by the use of bronze welding in repairing a mine-pump cross member that had broken. Bronze welding was decided upon to eliminate the preheating which cast-iron welding would have required, and the possibility of the piece getting out of alignment. The crack was first veed out with a pneumatic chisel. Dirt and other foreign matter were removed. Then the cross member was set upon a surface plate and clamped in position. Two welders completed the job in less than five hours.

COMMENT AND CRITICISM

Is Capital Available for Legitimate Prospects?

To the Editor of the "E. & M. J.":

From time to time one hears various statements to the effect that it is difficult or impossible to raise money to develop prospects. An article recently appeared in one mining publication in which the writer stated he had read various suggestions that the mining engineer get into the mining business for himself. In fact, he had read of one engineer who was carefully going over an old mining camp at his own expense to see if he could find evidence enough of additional orebodies to justify taking options and securing capital. The mining engineer who wrote the recent article referred to stated that he, also, had done just this very thing. He had carefully studied an old camp, and found the property, an old gold mine in one of our Western states, but is having difficulty getting capital. The various companies he has approached either want a very large property or else one with developed ore reserves. He estimates that the mine if reopened has large enough veins to output 100 tons a day. Although the information given is brief, the following facts are plain: The mine worked out its orebodies on the upper levels, and this engineer proposes to get some company or group of men to drive in the lower levels looking for a downward extension of the ore.

One constantly sees the statement in the mining press that legitimate mining prospects cannot get capital, but that the crooks can. There are always two sides to every question, and I would like to present the side of the exploration capital that is invited to take a chance in these schemes. Before going into generalities, it might be as well to consider the foregoing proposal first, and see why it is not attractive from the facts as presented.

Small mines as a general proposition are not very profitable. History shows that mines with the veins only big enough to produce 100 tons daily, although possibly paying some dividends, do not as a rule return the total capital expended from start to finish on the enterprise plus an attractive margin of profit, the nature of the risk considered. There are exceptions, of course.

The mine has to be good grade and the oreshoots very persistent to pay on a small-tonnage basis. Small oreshoots are not generally persistent. Had the ore in the mine in question been either high grade or persistent, and the enterprise profitable, the lower levels would have been pushed through until the chances of finding new ore were reasonably exhausted.

Now, there is nothing in the record as presented to show why the mine was closed down in the first place, so one assumes it was the usual cause—the company's funds became exhausted. One would probably be told that during periods of prosperity the company paid all its earnings in dividends, so that when the ore gave out it had no money with which to prospect. As a matter of fact, mines that have paid well generally die hard, and a determined effort is made to find the ore extensions.

It is also a fallacy in the mining-exploration business to assume that the old-timers were a bunch of fools who left the mine with a lot of rich ore covered up in the bottom. Sometimes this story has the variation that the superintendent was a crook and wanted to get the mine for himself. These same old-timers may not have been as well posted on geologic terms as we are, but the experience of most of us who have reopened old mines is that they did not often quit when ore was still to be had. In fact, their nose for ore made up for their lack of modern geologic theories.

What has happened to the mine in question? The upper levels had pay ore, which gave out in depth. Is this not the experience with the majority of ore deposits? Some go deeper than others, but there seems to be a downward limit to all orebodies. Some good geologic reasons would have to be advanced in this case to convince the experienced exploration or mining company that the ore would come back below. Many shallow enrichments in the Western states never made ore in depth.

The whole exploration question really resolves itself into the probable profits in relation to the gamble to be taken. Anybody can spend money in the exploration business, but it is an entirely different matter to make it. A few years ago the head of the exploration department of one of the large smelter companies published some figures on the results of the year's work, approximately as follows: Properties submitted to the company for purchase during the year totaled 4,000. Most of these were eliminated in the office from previous knowledge of the district or because the property on the face of the information submitted was not attractive. Four hundred properties were examined in detail. Two properties were taken under option and expenditures made on same for development work. Results a year later: one property given up and an extension of the terms asked on the other. This one was also abandoned later.

So we can say that out of 4,000 chances given this company it was interested to the extent of a preliminary examination in only 10 per cent, and out of this 10 per cent none made good.

The *Wall Street Journal* recently published a statement that a group of rich men had abandoned the attempt to secure a good mine after having 2,000 mines investigated without turning up anything of promise. The competition among the mining companies for new mines in Canada is keen, and large sums of money are spent annually in Canada on prospects both with and without merit. The competition is not so active in the United States, because the entire country has been fairly well combed over, and most of us feel that any proposition offered has been turned down by our competitors, probably for good reasons.

Also, the majority of new mines in Canada are opened with the public's money through the sale of stock. The Canadian people have been going through a wild speculation in Canadian mines for the last five years. Because several important new properties were opened during this period, the Canadian public has made money at the game. Our country went through the same experience in the Comstock days, in the Cripple Creek and Goldfield Nevada booms, but we were never as generally infected as the people of Canada are today.

The question will be asked: what are the requirements for a prospect to be attractive to exploration capital? This is difficult to answer because different individuals vary in their ideas of an attractive gamble; some will bet on a 50-50 shot, and others want the odds strongly in their favor. Money must be spent on several prospects to get one paying mine, so it becomes a question of what we win when we do get a mine. That is, will it be good enough to pay its own way, and also pay for the failures experimented with on the way? The size of the bill for dead horses depends on the skill of the persons making the commitments for the exploration capital. Development propositions

with only geologic theories to go on would not be attractive unless a possibility existed of developing big or rich orebodies.

A well-known axiom in finance rules that the greater the risk the greater the possible return must be to justify the larger risk. It costs no more to sink shafts and drive tunnels where the possible rewards are big than it does where they are moderate.

When it comes to reopening abandoned mines, such enterprises seem to have a large percentage of failures, unless the mine contained complex ores which were not amenable to treatment by old processes. Most of these latter have been snapped up in the last five or six years, improved selective flotation having made these ores commercial.

Exploration work today means taking long shots if the mine is to be in the United States, or looking for more virgin fields in foreign lands. This is just what American mining exploration companies are doing. W. R. WADE.

New York, N. Y.

An Unpardonable Condensation

To the Editor of "E.&M.J.":

Referring to the article on the "Determination of Plumbojarosite by Chemical Analysis," which appears on page 985 of the Dec. 22 issue of *Engineering and Mining Journal:*

My attention has been called to the fact that a part of a sentence is omitted. Beginning with the fourth line in the second paragraph the sentence now reads, "The filtrate contains the lead from the oxides, carbonates, and sulphide and plumbojarosite." It should read, "The filtrate contains the lead from the oxides, carbonates, and sulphates. The residue contains lead sulphide and plumbojarosite." D. A. LYON,
Supervising Engineer,
U. S. Bureau of Mines.

Salt Lake City, Utah.

One Touch of Nature

To the Editor of "E.&M.J.":

You have brightened my Christmas very much by your editorial in the Dec. 8 issue on "Health Preservation as Important as Accident Prevention." When I read of the introduction of a bill in the Senate for the creation of a National Institute of Health, and the recommendation report of the committee, I recalled the old days in mines and smelters. Lord, what a difference!

Senator Ransdell, of Louisiana, has earned my respect and gratitude, and the Senate committee also for the wording of their recommendation. The whole article is warm-hearted. Thank you. WILLIAM H. BAUR.

Silver Lake, Mont.

Psychology of the "Health Audit"

To the Editor of "E.&M.J.":

Your editorial on health of presidents of the United States calls to mind an article on "Health Audits" in the *American Mercury* for October, 1928. A prosperous business man who eats plentifully, imbibes with a will, and plays golf every day enjoys excellent health. He is approached with a proposal of health audit. "Certainly, why not? My books are audited to reveal any lurking faults. Why not my health, which is so important?" The audit was made and the man, after being informed of various imperfections, retired precipitately to bed, afflicted with nausea, vomiting, and a conviction that he was not at all well. For months he led a very abstemious life, and became so low in spirit, health, and activity that his family forced him to consult their physician. Even he was only partly successful in inducing the patient to return in a measure to his former happy way of living. The latter insists that his life has been lengthened ten years by the audit, although he has only lived two and a half years since the audit was made. He intends to be reexamined next year. The article is written by Logan Clendening.

I wonder what this has to do with a friend of mine in a mining camp who was a hell raiser and never lost a shift. But when he settled down, as it were, he began to feel not at all well and lose time. A. M. RODGERS.

Middletown, N. Y.

Two Geological Reports Needed

To the Editor of "E. & M. J.":

From the last annual report of Director George Otis Smith of the U. S. Geological Survey it appears that Adolph Knopf's manuscript, "Geology and Ore Deposits of the Mother Lode Region of California," has been completed. In view of the fact that comparatively few authoritative accounts of this region have appeared, and that these are now so old as to be of relatively small value, it is hoped that the director will speed up the printing of this professional paper and arrange for its prompt distribution. Mining men are also desirous of seeing the Allegheny report in print. Both of these reports cover areas that are of present interest to California mining men.

Geological investigation in both of these localities by the Survey had been neglected until the last few years, and prompt publication of the reports should be especially helpful. ENGINEER.

San Francisco, Calif.

By The Way

Mornin' on the Desert

THE Editor has received from the West a postcard containing the following verses, the spirit of which he would share with readers of *Engineering and Mining Journal,* regretting, however, that he cannot pass on, also, the view of the patch of sagebrush on which the poem, which was found written on the door of an old cabin in southern Nevada, was surprinted:

Mornin' on the desert, and the wind is blowin' free,
And it's ours, jest for the breathin', so let's fill up, you and me.
No more stuffy cities, where you have to pay to breathe,
Where the helpless human creatures move and throng and strive and seethe.

Mornin' on the desert, and the air is like a wine,
And it seems like all creation has been made for me and mine.
No house to stop my vision, save a neighbor's miles away,
And the little dobe shanty that belongs to me and May.

Lonesome? Not a minute! Why I've got these mountains here,
That was put here just to please me, with their blush and frown and cheer.
They're waiting when the summer sun gets too sizzlin' hot,
An' we jest go campin' in 'em with a pan and coffee pot.

Mornin' on the desert—I can smell the sagebrush smoke,
I hate to see it burnin', but the land must sure be broke,
Ain't it jest a pity that wherever man may live,
He tears up much that's beautiful that the good God has to give?

"Sagebrush ain't so pretty?" Well, all eyes don't see the same.
Have you ever saw the moonlight turn it to a silvery flame?
An' that greasewood thicket yonder—Well, it smells jest awful sweet
When the night wind has been shakin' it—for its smell is hard to beat.

Lonesome? Well, I guess not! I've been lonesome in a town,
But I sure do love the desert with its stretches wide and brown.
All day through the sagebrush here the wind is blowin' free,
An' it's ours jest for the breathin', so let's fill up, you and me.

INDUSTRIAL PROGRESS

Anti-friction Bearings Cut Power Cost on Aerial Tramways

By D. C. SHERMAN
Sherman and Reilly, Inc.
Chattanooga, Tenn.

THE establishment of aërial tramways as an effective means of transporting bulk material, especially over difficult or broken terrain, has been followed by a continuous series of developments with a view toward improving their efficiency and operating economy. The greater part of such development has consisted in the devising of ways of increasing the capacities of individual systems, both as to volume of material and the distance it could be carried, without exceeding the economic or practical limitations of driving equipment. Or, to put it differently, since aërial tramways are essentially a friction load, means were sought of increasing their capacity per unit of driving power by decreasing the friction load. The most obvious method of reaching this end, and one adopted in the early stages of development, was that of balancing the load—in other words, of utilizing the energy developed by empty carriers returning to the loading point to assist the driving equipment to move loaded carriers to the discharge point.

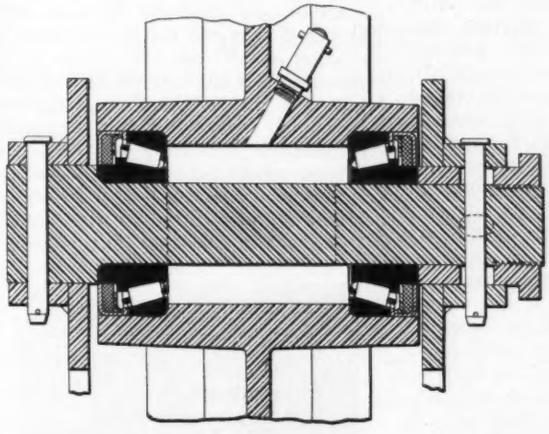


Fig. 1 — Cross section of sheave wheel mounting using tapered roller bearings. The section shows the ample provision made for lubricant storage.

Of the three general types of tramways in use at present, all but the simplest type, which is used only for short distances and low capacities, make use of load balancing to a greater or less degree. As a result, the power demand on the driving mechanism is reduced to an amount necessary to overcome the residual load caused by the difference between elevations of the terminals, and to overcome the friction in the sheave wheels and that of the wheels on the rope. A further possibility for reducing the power demand of such systems still existed, the point of attack being in the sheave wheels themselves. The solution of the problems involved was fairly obvious, consisting as it did of the application of anti-friction bearings, of a type capable of meeting all the requirements of the service, to the sheave wheels. The results that have been obtained, where the application was made, have more than borne out the predictions concerning them.

Selection of a proper bearing for the service and development of a type of mounting that would be suitable under all conditions was not a particularly simple matter, because of the requirements that had to be met. Probably the most important requirement, from all standpoints, is that of dependability. Aërial tramways are often many miles long and operate over territory of such a nature as to make it impractical, if not impossible, to inspect them or even to get at them if something goes wrong. Consequently, any breakdown out on the line is a serious matter, since the whole system may be tied up and considerable damage done before the fact that trouble exists becomes known. The difficulty in meeting this requirement was responsible for keeping plain bearings as standard for a long time, as it was feared that hardened tool-steel balls or rollers might break under the variations in temperature and load stresses arising in service. Conversely, this same factor was instrumental in determining the bearing selection that was actually made.

Another highly important requirement is ability to carry thrust loads. In the first place, the carriers have to run around curved rails at the terminals, both when they are heavily loaded and when they are unloaded. The carrier wheels are also subjected to thrust loads of varying intensity when out on the line, such loads being caused by a swaying of the bucket and by that of the line itself. If a bearing is employed that will not support the sheave firmly against thrust, and hold it in alignment, trouble of various sorts is bound to ensue. For one thing, side looseness or wabble of the sheaves causes the sides of the rims to rub against the rope, and produces considerable wear, not only of the sheave rims but of the rope as well. There are also other requirements, concerning ease of lubrication, ability to hold to original setting, and radial load safety factors.

In spite of these difficulties, an anti-friction bearing mounting for carriers incorporating Timken bearings was worked out that has proved remarkably successful in service. A section of this mounting is shown in Fig. 1. It was realized in the beginning that the design of a mounting that would give good results involved more than the mere substitution of roller for plain bearings in the old mounting. Rather, it was necessary to design all parts of the apparatus affected for the bearings,

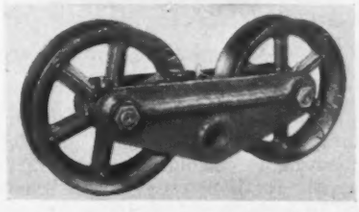


Fig. 2—Carrier truck construction designed for roller bearing application, showing the rigidity and simplicity of the design

so that not only would full advantage be taken of their characteristics, but full provision would be made for their requirements.

Carrier truck construction where plain bearings are used usually consists of two side plates fastened together at the center or ends by a cast spreader. The sheave pin may either be pressed

into the sheave, and revolve in brass bearings bolted to the side plates, or the sheave may be loose on the pin, and the latter fastened to the side plates to act as an additional stiffener. In the new mounting, an exterior view of which is shown in Fig. 2, this construction has been altered in the interests of greater rigidity and better alignment of the sheaves. The trucks are made integral, the side plates being made of steel sections permanently and rigidly connected together by electric welds. Additional bracing is provided by ribs welded to the outer surface of the plates. The sheave pins are also rigidly secured to both sides of the truck frame to form a brace through the axis of the sheave.

Referring back to Fig. 1, it will be seen that the bearing mounting proper is quite simple. Two bearings are used, the cups, or outer races, being pressed into the sheave hub, and the cones given a light fit on the pin. The pins are locked against turning by a dowel pin located so as to be easily accessible. Bearings are definitely located by hexagonal nuts on the outside of the side plates. The closures are of a character adapted to positive retention of the lubricant, and sufficient space is left

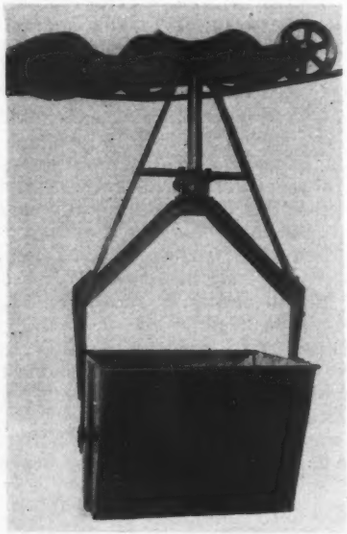


Fig. 4—Complete carrier equipped with roller bearings

in the interior of the sheave hub for the storage of an ample supply. The whole mounting is calculated to form a rigid support for both sheaves and bearings, and to keep them both in perfect alignment. Adequate lubricant seals are provided, and the bearing adjustment is placed where it is accessible.

Among the results in the way of improved operating efficiency and economy that have followed the use of this particular carrier mounting, probably the most important has been the saving in power. Although this saving is undoubtedly large, it is difficult to measure it exactly for several reasons. For one thing, though the coefficient of friction in roller bearings is constant, in plain bearings it varies greatly. Since, in the case of the latter, there is seldom effective means of retaining the lubricant, most of it is squeezed out some time after it has been applied, so that

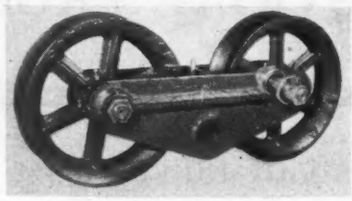


Fig. 3—Another view of the carrier truck showing a bearing assembly

conditions at any one time will vary from well lubricated to poorly lubricated as between the different carriers on the line. Furthermore, as the plain bearings wear, the sheaves are thrown more or less out of line, and an appreciable dragging action takes place: in other words, an increase in the overall friction of the load that should be rightly charged to the bearings, but the exact amount of which is difficult to determine.

It is a safe assumption that with tapered roller bearing carriers the power requirements of the average tramway system are reduced two-thirds. Tests have shown that carriers equipped with roller bearings have a constant coefficient of friction of approximately 0.006. Carriers with plain bearings had a coefficient of friction of approximately 0.016, which was usually arbitrarily raised to 0.02 to take care of the increase caused by indifferent lubrication. In addition, lump increments of power were added because it was found that frequently, in practice, the friction was either greater than that assumed in the preliminary calculations, or became greater. Actually, if the plain bearings were closely fitted, the friction was a little high at first, dropped off as the bearings wore in, and rose again as rubbing began to take place. On the other hand, with roller bearings the friction remains uniform, and is therefore dependable. It is true that the actual reduction of journal friction is not truly indicated by comparing the respective coefficients, as there still remains the rolling friction between the track cable and the sheaves. Nevertheless, it will be found that the original statement as to power savings holds.

The reduction in friction thus obtained operates in other ways to improve the effectiveness of the carriers. For instance, when they are manually loaded or dumped, they are usually pushed around the station by hand. The reduced friction makes the work much easier, and often reduces the number of men required on a system of given capacity. It is often desirable to coast the carriers from the detacher to some other point, possibly the loading or dumping point, and thence to the attacher. Sometimes, in addition, they must pass through a junction station, or certain types of angle stations. The uniform coefficient of friction that characterizes roller bearings not only makes such procedure easy—it makes it possible. In plain bearings the variable friction causes some carriers to stall and others to attain too much speed on inclines whose slope has been fixed to take care of the average carrier.

The effect of roller bearings on two other phases of carrier operation is of equal interest. First is the matter of lubrication. That the roller-bearing mounting is arranged to form a leak-proof seal has already been indicated, and some of the difficulties experienced in lubricating plain bearings have also been outlined. The net result of these conditions is that not only the amount of lubricant used is greatly decreased, by as much as 80 to 90 per cent in some cases, but the expense and trouble of applying it are also reduced. With plain bearings the over-all expense of labor for lubrication is often quite large, although variable according to the physical condition of the bearings. When new it is only necessary to lubricate them once per shift, but after some wear it becomes necessary to lubricate them twice a day. After reaching this point the bearings are usually discarded and replaced by new ones. The labor required on the average installation usually amounts to the entire time of one man, and on large installations to the entire time of several men, which makes it rather an expensive item in operating costs. Roller bearings, mounted as has been described, have required attention only at periods of from three to six months,

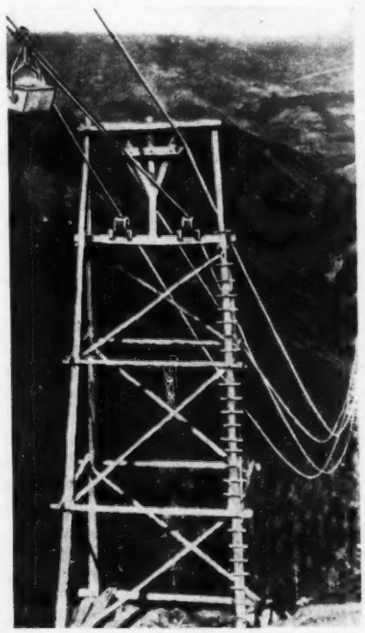


Fig 5—Typical aërial tramway installation employing anti-friction bearing carriers

depending on circumstances, and the expense for labor is practically eliminated.

As to maintenance, it may be divided

under two heads: the maintenance of the carriers proper, and the maintenance of the lines and other equipment directly traceable to the bearings. With regard to the former, in the case of plain bearings the wear on the bearings causes the sheaves to become steadily looser and more wabbly, until the point is reached where the bearings have to be replaced by new ones. In the meantime, the sheaves which are out of line have been wearing the tram lines unduly, and have been the cause of imposing unnecessary strains on the driving apparatus, all of which adds to the general maintenance costs. In addition there is always the possibility of a carrier jamming out on the line somewhere, and causing damage that will cost much to repair, to say nothing of the delay and expense of having the system inoperative while repairs are being made. Naturally, it is customary to replace plain bearings before such a stage is reached, but even then the cost of the bearings and of the labor necessary to replace them may easily, especially on large systems, amount to a very material item. When the carriers are mounted on roller bearings, a large share of this expense is eliminated. The bearings hold the wheels in permanent alignment, and, not being subject to wear themselves, they need not be replaced. Furthermore, the materials of which they are made, and the method of construction employed in making them, preclude any possibility of damage or failure either because of wide variations in temperature or sudden fluctuations in load.

To sum up: The bearings with which the carrier sheaves are equipped have a decided influence on the performance of the tramway, the advantage being largely on the side of the roller bearings. These advantages are anything but hypothetical; the bearings were not applied until a series of severe tests had determined their suitability, and the statements made have an additional basis in the records that have been obtained in actual performance. Tapered roller bearings, then, go a long way toward producing the ideal minimizing of the tramway friction load that is begun by simple balancing of the load.

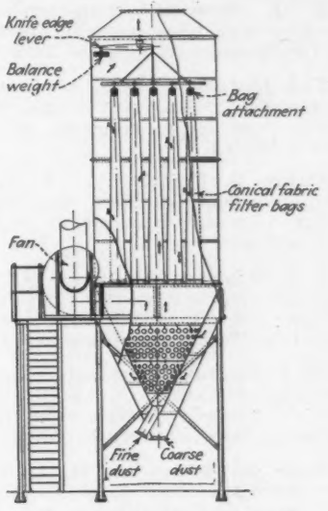
The Equipment Review

A DUST COLLECTOR originally designed for recovering litharge and red lead dust but since applied in other industries has recently been given a public demonstration by the makers, the A. L. M. Engineering Company, Ltd., Hawthorne Road, Bootle, England. The company is controlled by the Associated Lead Manufacturers, Ltd., one of whose engineers, H. Waring, is the inventor of the new collector. The device is an improved bag collector in which a cyclone removes a considerable portion of the dust before the dust-laden air reaches the bags, according to December issue of *The Mining Magazine*. A vertical section is shown in the accompanying sketch.

Ordinary dust collectors, though efficient in producing clean air when in perfect order, have the disadvantage oftentimes that hard particles are driven, sometimes at a high velocity, against the soft fabric of the bag, so that the latter is often worn out rapidly. Another disadvantage is that, as the dust-laden air is forced or sucked up into the bag, the dust particles settle on the inside and close up the pores of the fabric so that a constantly increasing pressure is required to enable filtration of the air to proceed. This means waste of power. The fabric, moreover, becomes so clogged with dust that it may speedily cease to act as a filter. To prevent this it must be violently shaken or beaten to detach the cake of dust formed on the inside. These disadvantages, it is said, have been overcome in the new collector.

At the base of the bags a cyclone separator is provided for the preliminary removal of a portion of the dust. Cyclone separators often suffer from the wear and tear caused by the swiftly moving hard particles. To obviate this defect the inventor introduced a number of small currents in the inner plate of the cyclone which break up the air into a large number of small currents meeting each other so as to destroy almost entirely the high velocity they previously possessed. The air being at this moment nearly stationary, a far larger volume of the dust naturally settles down and can be removed, sometimes in one conveyor, sometimes in two, which receive their feed in different parts of the cyclone separator and deliver products that differ in the actual size of particles. In some operations this partial separation has proved of value. The proportion of the dust collected in the separator varies with the nature of the dust and other circumstances; in many instances it is about 80 per cent, sometimes as much as 93, which is collected by the separator, leaving only 7 per cent to be caught by the bags.

Length of service of a bag used for dust collection is variable, although usually short. The patentees of the new collector have no information as to the probable life of the bags used with it, for it is stated that these have been in constant operation for two years without showing signs of wear and tear. The bags are conical and are fixed at the bottom to a plate containing circular holes, through which the air, still containing a certain amount of dust, can proceed gently and quietly. At the apex each is attached to a mild-steel tubular support suspended from a mild-steel lever with a knife-edge and a counterweight for balancing purposes at the other end. In this manner the filter bags are kept at a constant, predetermined tension. An accumulation, even a small one, of dust on the fabric raises the counterweight and causes the bags to sag; this action dislodges the dust, the counterweight drops, and the bag is in this way gently shaken. When properly constructed and run the bags remain clean and require no other shaking and no beating or other violent treatment. In some installations an additional device is useful in insuring a more regular gentle shaking. Underneath the base of the system of bags and above the cyclone separator is an iron sector which slowly rotates so that it closes the orifice at the bottom of each bag at regular intervals, the speed of rotation being suited to the needs of the particular dust in question. When the orifice is closed the pressure of the air is shut off and the dust is gently released from the slides of the filter bags.



Vertical section of Waring dust collector

The collector is said to have been found valuable in connection with the dry cleaning of coal. Large units have also been supplied to tin smelters in England and Germany.

INDUSTRIAL NOTES

Curry S. Prescott is now president of The Prescott Company, of Menominee, Mich. He succeeds his father, the late Fred M. Prescott, who died recently.

General Refractories Company has changed the address of its Detroit office to 6-230 General Motors Building, Detroit, Mich. This office will continue to be in charge of J. L. Graham.

Robert M. Gates, who is well known as the manager of the industrial department of The Superheater Company, has been elected vice-president of that company. Mr. Gates affiliated himself with The Superheater Company in 1922 and has since been actively engaged in directing the engineering and sales of Elesco superheaters for stationary power plants and special pipe coils for the oil and other industries.

Personal Notes

L. C. Penhoel, president of the Southwestern Engineering Corporation, of Los Angeles, is in El Paso.

A. E. Ring, assistant manager of the western mining department of American Smelting & Refining, is in Denver, Colo.

E. J. Atckison, vice-president of Southwestern Engineering Corporation, of Los Angeles, is in New York City.

T. J. Jones is in charge of operations at the Penn mine, near Campo Seco, Calif., now being reopened by San Mateo Mining.

Alonzo D. Nicholas, secretary-treasurer of Calumet & Hecla Consolidated Copper Company, is at present in Calumet on business.

H. R. Robbins, consulting metallurgical engineer for Oriental Consolidated Mining, has left Korea on a business trip to Kalgoorlie, via Singapore.

H. I. Altshuler has been appointed consulting engineer to the Compañia de Real del Monte y Pachuca, operating at Pachuca, State of Hidalgo, Mexico.

Roger W. Straus and **H. A. Guess,** vice-presidents of American Smelting & Refining, sailed for Europe from New York on the "Ile de France" recently.

Fraser D. Reid, of Cobalt, and **W. B. Timms,** of Ottawa, have been elected members of the council of the Association of Professional Engineers of Ontario.

C. Colcock Jones, consulting mining engineer, of Los Angeles, is in Cochise County, Ariz., on professional business in connection with the Red Bird and other mines.

Edwin Self, mining engineer, of Johannesburg, South Africa, who was a resident of Phoenix, Ariz., about twenty years ago, recently visited the last-named city.

Samuel Barker, Jr., managing director of Basin Montana Tunnel, and consulting engineer of Butte Copper & Zinc, recently returned to Butte after a trip to New York City.

G. C. Branner, state geologist of Arkansas, was recently in Washington, D. C., conferring with officials of the U. S. Geological Survey in regard to the Arkansas geologic map.

Robert E. Tally, general manager of United Verde Copper, has been appointed a member of the Board of Regents of the University of Arizona for a term of eight years.

G. A. Joslin, of Los Angeles, has gone to Central America, where he expects to spend two or three months on mining examinations. **Kenneth MacIsaac** accompanies him as assistant.

J. E. Imrie, consulting mechanical engineer, engaged in designing the Flin Flon flotation plant for Hudson Bay Mining & Smelting, in northern Manitoba, was recently in Salt Lake City.

W. C. Siderfin, formerly connected with the Clark interests in Montana, has been elected president of Butte Independent Mines, operating in the southwest part of the Butte district of Montana.

John A. Reid, mining engineer, is making an examination of the Tough-Oakes mine, in the Kirkland Lake district of Ontario, for the provincial government, as the result of complaints by Canadian stockholders in the company.

G. Lister Carlisle, mining engineer, has returned from Central Africa, where he spent three months in Tanganyika. Mr. Carlisle organized the Carlisle-Clark African Expedition of the American Museum of Natural History, of New York City.

Thomas Kekich, formerly connected with Anaconda Copper and Cerro de Pasco, recently left the United States for the Mines de Bor, Serbia, in connection with a position he accepted with the Peirce-Smith Converter Company, of New York.

Henry Morse, formerly mining engineer with Butte & Superior Mining, is consulting engineer of Butte Homestake Mining, a company recently formed by **E. J. Dailey,** of Butte, Mont., to take over 82 claims, north and northeast of Butte.

Victor A. James, who for several years was associated with Dome Mines, is now a member of the firm of Wright, Boydell, James & Associates, consulting mining engineers and geologists, with offices at 310-311 McKinnon Building, Toronto, Ont.

Jerome E. Machamer is now engaged in research work in the mining engineering department of the University of Illinois. He may be reached at Room 210, Transportation Building, University of Illinois, Urbana, Ill.

Scott Turner, director of the Bureau of Mines, has been appointed to the Advisory Committee of the Federal Oil Conservation Board as the representative of the Department of Commerce by William F. Whiting, Secretary of Commerce.

Arthur B. Swanson, who recently returned to the United States from Ecuador, where he was connected with the South American Development Company, has been appointed superintendent of Pend Oreille Lead & Zinc, operating in the Pend Oreille district of Washington.

James S. Douglas, president of United Verde Extension Mining, has returned to Douglas, Ariz., after an eight months' absence, spent mostly in Europe and Africa. His trip to the latter continent was made to investigate the copper properties in Namaqualand in which his company is interested.

S. G. Blaylock, vice-president and general manager of Consolidated Mining & Smelting of Canada, has left Trail for Europe, where he expects to spend two or three months on a tour of the chief smelting centers. **E. M. Stiles,** of the engineering staff at the Trail smelter, is accompanying Mr. Blaylock as technical assistant.

C. M. Warner, superintendent of the Herculaneum smelter of the St. Joseph Lead Company, has been transferred, temporarily, to the New York offices of the company, where he will assist in the sales promotion of Bunker Hill zinc. **C. W. Badgeley,** assistant smelter superintendent, will be in charge of operations at the smelter during Mr. Warner's absence.

Paul W. Redeker, efficiency engineer for Copper Range, in the Michigan copper district, has been appointed superintendent of the company's Baltic mine, to succeed **Cyril J. McKie.** Mr. McKie resigned to become underground superintendent of Quincy Mining. **Walfred Been,** a graduate of of Michigan College of Mines and Technology, will succeed Mr. Redeker as efficiency engineer.

OBITUARY

Arnold Cordes, mining engineer, died in Los Angeles on Dec. 30. Mr. Cordes, who was born in Germany, was 77 years old.

Theodore Brown, who went to the Coeur d'Alene district in the days of the gold rush on Prichard Creek, in 1884, died on Jan. 14 at Kellogg, Idaho. At the time of his death he was president and general manager of Bobby Anderson Mining.

Sir William Boyd Dawkins, well-known English geologist, died in Cheshire, on Jan. 15, after a long illness. He was in charge of the geological survey for the British Channel tunnel, actual work on which was started in 1882. Sir William was 91 years old.

Clarence J. Rofelty, mining engineer and geologist, died at Globe, Ariz., of pneumonia on Jan. 5. He was born in Cincinnati, Ohio, on Nov. 7, 1887. He had been a resident of Globe for the last thirteen years and had been associated with the Old Dominion company during that period.

John D. Cuddihy, president of the Hancock and Oneco mining companies, died at his home in Calumet, Mich., on Jan. 15, after a short illness. For many years Mr. Cuddihy had been prominent in mining circles in the Michigan copper district. His father, Michael Cuddihy, was one of the first miners in the district.

Wheeler O. North died on Jan 17 at his home in La Jolla, Calif., after a brief illness. Mr. North was a graduate of the mining department of Leland Stanford University at Palo Alto, Calif., and started his mining career in Nevada. Subsequently he spent three years in Borneo. On returning to the United States he became assistant manager of the United Eastern Mine, in the Oatman district, Ariz. More recently, Mr. North was general manager of the Compañia Internacional Minera, S. A., operating in Zacatecas, Mexico, and a subsidiary of the Union Corporation, Ltd., of London.

NEWS OF THE WEEK

Summary

IMPROVEMENT of the status of employees was considered by the members of the Mining and Metallurgical Society of America at its annual meeting and dinner. G. T. Bridgman was elected president, succeeding Clinton H. Crane. Page 174.

* * *

Basin Montana Tunnel has completed installation of new equipment at its property in the Basin district of Montana, and preparations are now being made for driving of a long tunnel to cut the Grey Eagle vein. Page 171.

* * *

Ohio Copper has struck a body of silver-lead ore on the 700 level of its mine at Bingham, Utah. The strike is regarded as important because it is in the virgin limestone formation. Page 172.

* * *

Anaconda Copper won the appeal of the Metals Recovery suit over the Perkins flotation patent on Jan. 14. Page 170. At about the same time, Magma received a favorable verdict in the appeal of suit brought against it by Minerals Separation. Page 171.

* * *

Eureka Standard will install a new electric hoist at its four-compartment shaft in the Tintic district of Utah. Page 174.

* * *

Large new mill, with 100-ton hourly capacity, is being built on the Paxton lease, Tri-State district, by Commerce Mining & Royalty. Page 173.

* * *

United Verde will deepen its two shafts at Jerome to 5,000 ft., making them the deepest in the entire Southwest. Page 175.

* * *

Ardsley Butte has struck an extension of the Highland vein on the No. 5 level of its mine in the southwest part of the Butte district. Page 171.

International Nickel Stock Continues to Soar as Ore Is Cut on Four Levels

Prices on Jan. 19 Give a Market Valuation of $750,000,000—Developments at Frood Are Confirming Drill Results, According to Report by International President

TORONTO, ONT., Jan. 19, 1929.—The nickel situation continues to occupy the center of the mining stage. International Nickel, which has 11,258,203 common shares outstanding and $8,900,000 worth of preferred shares, had a market valuation on Jan. 19 of $750,000,000. On Jan. 18 buying orders on the New York Stock Exchange had accumulated to such a volume that a special meeting had to be held to set the price, which was put at $63 for each share of the new International Nickel of Canada stock, or $5 higher than the closing price of the previous night.

Developments on the lower levels of the Mond section of the Frood mine showed sections across the full width of more than $100 a ton, gross value. During December, Mond shipped 7,500 tons of ore from development work on the 2,800 and 3,100 levels, which gave a smelter return of more than $400,000, or better than $50 a ton. On the 2,800 level, the Mond has found widths up to 180 ft. and on the 3,100 level, where the ore is richer, widths up to 100 ft.

A statement just issued by R. C. Stanley, president of International Nickel, reports that the footwall orebody has been cut on four levels. On the 1,200 level the ore averages 5 per cent, combined nickel and copper content, across a width of 100 ft.; on the 1,600 level, 6 per cent across 45 ft.; on the 2,400 level, 8 per cent across 75 ft.; and on the 2,800 level, 22½ per cent, across 62 ft. Precious metal values were not given by Mr. Stanley. The footwall orebody is approximately 60 ft. south of the main orebody, which has not yet been cut. Sufficient ore to meet requirements for many years has already been indicated.

Exports from Canada of nickel of all grades in 1928 amounted to 97,167,000 lb., an increase of 26,500,000 lb. over the 1927 record. The output of nickel will be a controlling factor in the production of copper and precious metals from the Frood, and if the rapid increase in nickel sales is continued, original estimates of copper and precious-metal production will have to be considerably increased.

A great deal of dissatisfaction exists among Canadian Mond shareholders regarding the merger with International, which is now officially reported as having been consummated. They were not consulted regarding the transaction, and, under the present arrangements, when they turn in their Mond stock, all they receive are certificates of deposit, which are not negotiable for about two months. It is hoped, however, that the completion of the negotiations having been assured, some arrangement will be made to extend the time and to issue negotiable certificates of deposit.

Feldspar Merger of Five Companies Is Consummated

FORMATION of the Consolidated Feldspar Corporation, with assets of more than $8,000,000, was announced in Baltimore recently. A. J. Fink was made chairman of the board and Herbert P. Margerum, formerly president of Golding Sons Company, of Trenton, N. J., was elected president.

The new corporation has acquired the assets of Golding Sons Company, Erwin Feldspar Company, of North Carolina; the Dominion Feldspar Corporation, of Canada and New York; Maine Feldspar Company, of Brunswick, Ga.; Isco-Bautz, Inc., of Murphysboro, Ill.; Feldspar Quarries Company, Ltd., of Canada, and the Norman G. Smith Company, of North Carolina.

The capitalization of the consolidated corporation is $5,000,000, consisting of 50,000 shares of $7 cumulative preferred stock without par value and 300,000 shares of common stock without par value.

Chief Consolidated Strikes New Ore Near North Lily

An important discovery has been made in the Coyote area, Tintic district, Utah, by Chief Consolidated Mining, 700 ft. west of the North Lily orebody. A drift from the North Lily 900 level has struck in a monzonite dike, 500 ft. wide, 3 ft. of ore assaying 18 oz. of silver to the ton and 24 per cent lead. Drifting and raising on the ore toward the Ophir formation will be started at once.

Metal Tariff Hearings Under Way in Washington

By Paul Wooton
Washington Correspondent

PRODUCERS of lead, zinc, molybdenum, and quicksilver regard the maintenance of the rates of duty in the existing tariff law as imperative in the welfare of those industries, M. W. Kriegh, head of the metal tariffs division of the American Mining Congress, told the House Committee on Ways and Means. He pointed out, however, that developments in the lead and zinc industries might be such as to require later a request for some additional protection. At the same time Mr. Kriegh stated that it would be necessary to increase the duty on antimony, arsenic, pyrites, kaolin, gypsum, mica, and tungsten if these industries are to prosper.

Mr. Kriegh was questioned, particularly from the Democratic side of the committee rostrum, as to the possibilities of a request for a duty on copper or any other mineral product which has an exportable surplus. Mr. Kriegh stated that no request for duties on such minerals had come to the Mining Congress and that no study had been given to that problem, with the exception of zinc, which he declared is facing a serious menace because of competition from Canada and Mexico.

Representative Hull, of Tennessee, a Democratic member of the committee, inquired as to the part American operators have taken in the forming of an international cartel interested in the limitation of production.

On antimony an increase from 2c. to 4c. per pound was asked; on arsenic, 6c. per pound; on white arsenic, 4c. per pound; on barytes, $8 per short ton; on bauxite, $3 per long ton; on crude feldspar, $2 per ton; on ground feldspar, $6 per ton; on kaolin, $3.75 per ton. The manganese producers request a rate of 1½c. per pound on the manganese content of imported ore and the lowering of the percentage of manganese so as to include manganiferous iron ores. The contention was advanced that zinc and lead, comparable commodities, are allowed 1½c. per pound for the metal contained in ores.

A very complete summary of tariff information covering the metals schedule was prepared by the metals division of the Federal Trade Commission, of which F. Morton Leonard is the mining engineer in charge. This summary covers 324 printed pages. The metals division did the fact-finding on 153 paragraphs, including the non-metallic mineral products.

Decision in Metals Recovery Suit Upheld in Appeal Court

ON JAN. 14, the U. S. Circuit Court of Appeals at San Francisco upheld the decision of Judge Bourquin, of the U. S. District Court of Montana, made last February in the case of Metals Recovery vs. Anaconda Copper. Metals Recovery in its suit had charged Anaconda with infringing the Perkins flotation patent, which, it was claimed, included the use of xanthate, the reagent used by Anaconda at its flotation plants. In his decision, Judge Bourquin maintained that the Perkins patent was too broad and too far-reaching in scope to be definitely interpreted.

In upholding the Bourquin decision, only this point was considered by the court of appeals. However, Judge Dietrich stated in his opinion that in regard to the conclusions of the lower court "that xanthate, the alleged infringing agent employed by defendant, does not fall within the patent claims, fairly interpreted and that it was discovered by one Martin, approximately two years prior to the claimed date of Perkins' invention," the court of appeals was convinced they should not be disturbed.

Repeal of Minnesota Ore Tax Asked by Operators

On Jan. 15, the Minnesota State Senate received a bill to repeal the state tax on iron-ore royalties. When the bill was passed, in 1923, it provided for a 6 per cent tax to be levied by the state on iron-ore royalties, the intention being that the fee owner of mining lands should pay the tax, and not the operating companies. The courts, however, construed the law to apply to the operating companies.

In 1927, the tax cost to the industry was 26 per cent of the value of all the iron ore produced. As a result of this large addition to costs, development work has been stifled, unemployment has resulted, and production of any but high-grade ore has been discouraged. The state legislature will consider several other proposals to relieve the mining industry of the tax burden besides the proposed repeal of the royalties tax.

San Mateo Mill Ready Soon

San Mateo Mining is completing its flotation mill, at Campo Seco, Calaveras County, Calif., and has unwatered the mine workings. The property was formerly operated by Penn Mining, but has been closed since 1919. Previous to that, operations had been maintained continuously over a period of nineteen years. The present operators intend to mine and mill the ore left in the stopes when the property was closed down. San Mateo's ore contains copper and zinc.

Noranda Will Overhaul First Reverberatory Furnace

Production from the Noranda mine is being switched over from its first to its second reverberatory at the smelter in the Rouyn district, Quebec, for the purpose of permitting the complete overhauling of the first furnace which has now been in steady operation for more than a year. Underground developments at the mine continue favorable, and further diamond drilling indicates an enlargement of the H orebody around a depth of 1,200 ft.

Rice Attorney Indicted for Dodging Income Tax

Nash Rockwood, who has been a member of the legal council of George Graham Rice in several of the latter's trials, has been indicted for failure to file income tax returns in 1924, 1925, 1926, and 1927, as a result of testimony given by the mining promoter in his most recent trial. Testifying in his own defense, Rice swore at that time that he had paid lawyers more than $700,000 in his fight against indictment for using the mails with intent to defraud. This testimony attracted the attention of members of the Internal Revenue Department, and the indictment of Rockwood, who had formerly been county judge of Saratoga County, New York State, followed. Rice's appeal from his sentence to four years in the federal penitentiary will be heard in April.

Mexican M. & S. Mill Ready in Three Months

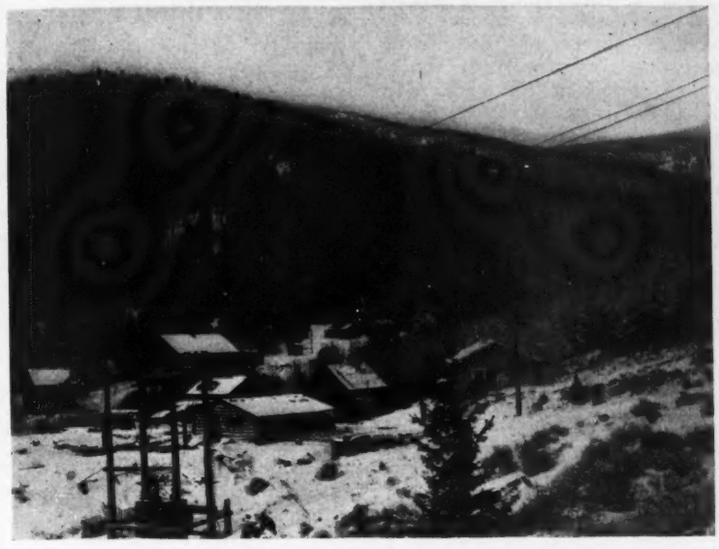
Machinery is now being installed in the new concentrator being built by Mexican Mining & Smelting at its El Ramal mine, in Sinaloa, Mexico. Buildings for living quarters and housing the mill have been completed, according to report, and those interested expect that production will start within three months. The mill will handle 25 tons daily.

Report Favorably on Vinson Bill on War Minerals

Washington, D. C., Jan. 23.—The Vinson bill, proposing a review by the Supreme Court of the District of Columbia of the War Minerals Relief Act, with regard to the purchase of property and payment of interest, was reported on favorably this morning by the Committee on Mines and Mining of the House of Representatives.

Century Zinc Starts New Shaft on Scott Lease

Century Zinc has started sinking a shaft on its Scott lease, which consists of about 300 acres, east of Hockerville, Okla. More than 300 drill holes have been put down on the lease in the last two years and more than 1,000,000 tons of commercial ore has been developed, according to S. H. Davis, manager. A second shaft will be started immediately and plans for a large mill for the property now are being made.



Basin Montana Completes Installing New Equipment

BASIN Montana Tunnel, operating northeast of Basin, Mont., has completed installation of a 600-cu.ft. Ingersoll-Rand compressor, connected to a 100-hp. Westinghouse variable-speed motor by short-belt drive, and is now putting in lead-covered cable in its south Grey Eagle tunnel as far as the winze, where a 50-hp. Vulcan electric hoist will be installed. A No. 7 Knowles sinker pump is now unwatering the winze, which taps the large bodies of lead-zinc-silver ore that could not be shipped in the early days because of the high zinc content. The winze, which is 210 ft. deep, is unwatered to a point 100 ft. below the present level of the Grey Eagle tunnel.

The company now employs 27 men, under the supervision of Samuel Barker, Jr. The illustration above shows the Grey Eagle property of the company, at the northern end of its holdings. In the spring a long tunnel will be driven to tap the vein south of the Grey Eagle. In the foreground of the picture is the transformer recently installed to step the voltage from the 66,000-volt line of the Montana Power Company down to 2,200 volts.

Expect Increase in Gold From Kirkland Lake in 1929

THE situation throughout the Kirkland Lake district is promising, and developments indicate a further increase in gold production during 1929. The enlargement of the Lake Shore mill is practically completed and will permit treatment of 350,000 to 400,000 tons a year. Teck-Hughes' main shaft has reached a depth of 2,750 ft. and will be continued to 3,000 ft. When that point is reached six new levels will be opened. When these have been developed another mill unit of 300 tons a day will probably be built, and may be completed by the end of the present year. This will be in keeping with the policy announced at the annual meeting, when it was stated that the mill would be enlarged as mine developments warranted.

At the Wright-Hargreaves, though lower level developments during recent months have been quite favorable, the situation as a whole is by no means so promising and it is possible that some drastic readjustment will be necessary. The situation at the mine has necessitated the dropping of the next dividend, ordinarily due by Feb. 1, and may also result in cutting the mill tonnage considerably below 700 tons a day. If this is done it is possible that the company will have to draw on its surplus to meet operating expenses until such time as the mine has been developed ahead of the mill.

At the Crown Reserve property, east of Kirkland Lake, practically all work has been stopped as a result of the failure to develop commercial ore on the five new levels opened up to a depth of 1,200 ft. Diamond drilling will be done below the 1,200 level. If this does not give better results the property will be closed down. Above the 500 level estimates of developed ore are 152,218 tons, averaging $6.80. Possibly the property might be operated in conjunction with Associated Goldfields, which is working on a continuation of the same vein and which has a mill. The latter property is closed down at present, recoveries being much less than operating expenses.

Ardsley Butte Strikes Extension of Highland Vein

ARDSLEY BUTTE MINES CORPORATION, after cutting through two faults on its No. 5 level, has opened the western extension of the Highland vein in the Butte district of Montana. At the fault the vein was 70 ft. wide, but in drifting east this narrowed to 46 ft., of which 29 ft. is in commercial ore. Besides this there is a high-grade streak which is being sacked for shipment. The company is now drifting west toward the winze from the 365 level. This company recently put into operation a 250-hp. single-drum Ottumwa hoist with a rope speed of 870 f.p.m. and a new gallows frame 55 ft. high. Production last month averaged about 75 tons daily, but is now about 130 tons. As soon as ventilation is assured by connecting the winze to the No. 5 level, it is planned to ship 200 tons daily.

Ardsley Butte Extension Mining Company, after shipping 60 cars of silver ore from above the 150 level, has sunk its shaft to 250 ft. and has opened a vein 32 ft. wide on this level, of which 16 ft. is commercial ore. The company's property adjoins the Ardsley Butte Mines Corporation to the east.

Advice of Bureau of Mines Asked in Trail Smoke Case

For the first time during the protracted controversy over the damage done by fumes from the Trail smelter the advice of the U. S. Bureau of Mines has been sought. In compliance with a request from the State Department, metallurgists of the Bureau of Mines will now co-operate with a commission, composed of officials of the Department of Agriculture, that has been investigating the matter during the past year. A preliminary survey of the territory affected will be made at once by G. L. Oldright, supervising metallurgist for the Bureau at Salt Lake City.

The participation of the Bureau of Mines in this investigation is expected to insure the presentation of a well-rounded case to the International Joint Commission, which has the matter under consideration.

Magma Wins Appeal Suit From Minerals Separation

The U. S. Circuit Court of Appeals in Boston, Mass., has decided in favor of Magma Copper in the suit brought by Minerals Separation North American charging infringement of flotation patents. The U. S. district court of Maine, in which state Magma is incorporated, decided in favor of the Minerals Separation company last February. Validity of second or "solution" patent of Minerals Separation, which expired in June, 1927, was being contested. The district court had ordered an accounting to determine the amount of damage to be assessed against Magma for infringement.

First Paper of Mining Method Series Appears

INFORMATION Circular No. 6092, entitled "Method and Cost of Mining Magnetite in the Mineville District, New York," by A. M. Cummings, superintendent of mines at Mineville, has just been issued by the U. S. Bureau of Mines. This is the first of a series of papers to be issued showing the application of the various mining methods in the metal mines throughout the United States. These papers will include data on costs of shaft sinking, drifting, stoping, transport, and hoisting, expressed in units of labor and supplies consumed per ton, and, in some instances, in dollars and cents, where the management is willing to give these data.

The object is to supply mine operators throughout the United States with descriptive and cost data from all districts on each of the principal mining methods and on the various underground mining problems. Thus, the operator of an iron mine in Michigan will know how his method is being applied in the copper mines of Arizona and the anthracite miner will be able to learn about underground operations in metal mines.

Preparation of papers by the mine operator, in accordance with an outline supplied to him by the Bureau of Mines, will encourage him to compare his results with those obtained at mines similar to his and to study the reasons for any large difference.

Papers are now being prepared on properties in several mining districts, and within the next few months more districts will be added, so that within the year the Bureau will have published and distributed papers prepared by mine operators on mines using most of the mining methods.

These papers will be the basis for the study and publication of papers on separate mining problems, such as "Methods of Mine Exploration and Costs," "Shaft-Sinking Practice and Costs," "Methods of Drifting and Costs," "Comparison of Mining Results by the Different Mining Methods," "Mechanical Loading and Handling," "Underground Transportation," "Labor Efficiency," and "Pay Systems and General Underground Organization of Labor."

Probably the most important of the problems are the last two, as most mines can reduce their costs considerably by a careful survey of time wasted by the workmen owing to inefficient underground organization and by the introduction of ways to reduce this waste without added exertion by the workmen. Charles W. Wright, who is in charge of the mining division, states that the Bureau has thus far received most cordial co-operation from all the mining companies that have been asked to aid in this work, and the engineers in charge of operations at a number of the principal mines throughout the United States are busy gathering the data requested.

This study of mining methods by the Bureau was initiated by the present director, Scott Turner, and it is largely due to his personal acquaintance with the executive officers of the mining companies that they are ready to cooperate so willingly in this work. Mr. Wright has as his assistant Charles F. Jackson, formerly secretary to the A.I.M.E. Committee on Mining Methods.

United Verde Makes Electrical Survey of Mexican Land

THE general mine superintendent of United Verde Copper, W. V. DeCamp, has announced that an electrical survey is being made of 1,000 acres in Sonora, Mexico, on property known as the Independencia and owned by Dr. A. L. Gustetter, of Nogales, Ariz., and M. T. McCleary. The preliminary work of making the survey is being conducted by the Physical Exploration Company, of Madison, Wis., under the supervision of Dr. Louis B. Slichter. This will be followed by a campaign of diamond drilling.

Granby Ships New Machinery to Allenby Mill

GRANBY CONSOLIDATED evidently is contemplating important extensions to its Allenby mill, as it recently shipped about 100 tons of machinery from Anyox to Allenby, B. C. At the present price of copper, the Anyox mill is able to treat ore profitably that contains less than 1 per cent copper.

Construction work at the company's Bonanza mine is nearly finished, and shipping to Anyox is expected to start in February. About 500,000 tons of ore has been developed, and this reserve may be increased as the mine is opened up. The vein dips into the mountain, limiting the amount of exploration possible by diamond drilling until more underground development has been done.

N'Changa Exploration Shows 69 Ft. of Ore at 550 Level

Information has been received by cable from the company's manager in Africa stating that Borehole B.16 entered ore at an inclined depth of 305 ft., according to H. C. Hankins, secretary of N'Changa Copper Mines, operating in Northern Rhodesia. Assays from 305 ft. to 395 ft. (90 ft.) averaged 4.35 per cent copper, of which 98.39 per cent is sulphide. The estimated true width is 69 ft. and the hole is reported as still being in ore. Borehole B.16 is an inclined underground hole put down from the main shaft crosscut on the 300 level and entered the ore at a vertical depth below the surface of 550 ft.

Lead-Silver Orebody Struck by Ohio Copper

A BODY of lead-silver ore has been struck on the 700 level of Ohio Copper, at Bingham, Utah, below the Mascotte tunnel level, at a vertical depth of 1,500 ft. The area adjoins the Utah Copper, United States, and Bingham Mines properties. This strike was made in the vicinity of the diamond-drill hole put down on the recommendation of Ira B. Joralemon, consulting geologist, to explore the Commercial limestone, which, it was proved, underlies the northern two-thirds of the property.

Importance is attached to the discovery because it indicates a possibility of production in the virgin limestones of the property. Up to the present, output has been copper solely, from a crushed quartzite zone, mostly secured by leaching-in-place operations.

To prospect the Commercial limestone, a three-compartment shaft on a 45-deg. incline was sunk in the porphyry to the 700 level, and drifting through the quartzite started in December.

Ibex Mine, in Leadville District, Is Closed

After yielding about $25,000,000 in silver, lead, zinc, and copper in the last 40 years, the Ibex mine, on Johnny Hill, in the Leadville district of Colorado, has been closed. The property was operated by Ibex Mining, a closed corporation, but recently most of the work had been done by lessees. Development was by four vertical shafts to a depth of 1,250 ft. John Cortellini, who had been in charge of operations, will work the No. 4 shaft, which leads into the adjoining Minnie mine.

Mine Near Gunnison Sold

The Brooklyn Tunnel and the Harper group of mining claims on Galena mountain in the Rock Creek district, near Gunnison, Colo., which were worked for about 50 years by the late Robert Harper and sold to a New York concern for about $100,000, later passing to the ownership of Mary A. Gleason, of Longmont, Colo., have been sold to H. G. Setz, of Palm Springs, Calif. A trucking road between the mines and the railroad will be built to facilitate shipments.

Start Shipping from Midget

Mining operations have been started at the Midget mine, in the Cripple Creek district of Colorado, and about three carloads of gold ore are being shipped daily. In addition, Secured Mining, which owns the property, is shipping about three carloads daily from ore broken in the stopes, and from three to five carloads from the Midget dump. Shipments are made to the Golden Cycle mill. Retimbering of the Midget shaft below the No. 5 level is being undertaken at night.

Main Shaft of Moscow Silver Mines

Moscow Silver Shaft Will Be Deepened

MOSCOW SILVER MINES will sink the three-compartment shaft at its properties near Milford, Beaver County, Utah, to the 1,600 level, and start exploration of the Red Warrior limestone of Carboniferous age at that depth in the virgin ground north of the faulted segment of the deposit. Shipments of ore, containing silver, lead, and some gold, are now being made.

A pipe of ore, 3x5 ft., has been followed from the 1,400 level, where the shaft is bottomed, to the 1,500 level in an incline winze. At 1,510 ft., the ore widened to 10 ft. and was drifted on to the southwest, in the Red Warrior limestone, for 40 ft. The ore is netting from $800 to $1,000 a carload. G. S. Wilkin, who is in charge of operations, believes that the faulted segment has been struck. From the 1,250 level to the surface, this segment has produced $1,000,000.

Start Building Large Mill on Paxson Lease, in Tri-State

PIERS for an all-steel, 100-ton an hour concentrator on the Paxson lease of Commerce Mining & Royalty Company have been started. The Paxson lease is about two miles west of Baxter Springs, Kan., in the Tri-State district, in what is known as the West Baxter sheet-ground area. The mill will be one of the largest in the district when completed, and will be patterned somewhat after the all-steel mill built on the Blue Goose lease.

Prospect work was started on the lease several years ago. Drilling indicated a rich run of sheet-ground ore below the 300 level. The first shaft was started more than two years ago. The mine is in a new territory, and a considerable flow of water was encountered. A second shaft has been sunk to the water level, which is at present below 310 ft. Prospect drifts have been driven, and an orebody of sufficient worth to justify a large mill has been developed.

Seneca Is Exploring on Nos. 8 and 9 Levels

SENECA COPPER, in the Michigan district, is extending its richest levels, Nos. 8 and 9, in No. 1 shaft, both north and south. Shaft sinking will be resumed after drifting is well under way. As the shaft is deepened the expectation is that ground will improve in copper content, which has been characteristic of the Kearsarge lode both in the adjoining Ahmeek property and Mohawk No. 6 shaft. Depth also will widen the distance between the shaft and the Ahmeek boundary to the south.

Seneca also is driving its long drift on the third level from No. 1 shaft north of No. 2 toward No. 3. To expedite the work in No. 2, which is being stripped to regulation size between the 19 and 25 levels, both raising and sinking are in progress.

Branch Railroad Proposed for Falconbridge Nickel

THE Canadian Pacific Railway proposes to build a branch line from Stobie mine to the Falconbridge mine, in the Sudbury district. Before work is started, however, the application will have to be ratified by Parliament. A keen competition exists between Canadian National and the C.P.R. for entry into the different mining territories. The C.N.R., which is government owned, is endeavoring to head off the C.P.R. from some of its proposed branch-line developments. The whole matter will probably be aired before the Railway Committee of the Canadian Senate. Another proposed branch railroad line in a mining section is a branch of the T.&N.O. railroad from Timmins to Kamiskotia, Ont. The Hollinger mine has made application to the T.&N.O. for the construction of this branch. Diamond drilling and underground work on the property has shown a considerable tonnage of low-grade copper. According to report, Hollinger is planning to construct a mill and ship concentrate to the Noranda smelter.

Mason Valley Smelter Will Close on Feb. 1

OPERATION of the Mason Valley Mines copper smelter, at Thompson, Nev., will probably be suspended about Feb. 1, according to G. A. Kervin, general manager of the company. Rumors to this effect have been heard for some time. Last summer, the Balaklala mine, in California, which was one of the chief sources of supply, was closed. Ore reserves in the company's Bluestone mines are said to be practically exhausted. At the Mason Valley mine, an undetermined tonnage of low-grade ore remains. The company will probably sell all its Nevada holdings after the closing of the smelter.

The Thompson smelter was first started in 1912 and was operated until October, 1914. It remained idle until shortly before the entrance of the United States into the World War, but was closed down when the post-war depression forced the price of copper below 12c. It was not reopened until 1926, since when it has been in operation. The smelter was built at a cost of about $900,000 and includes two blast furnaces of 1,800-ton capacity.

Noble Five Developing Deadman Shoot on Bottom Level

NOBLE FIVE MINES, near Nelson, B. C., has drifted on the Deadman oreshoot in the bottom level of the mine for 250 ft., and the face of the drift is still in ore. Width has not yet been determined, but a crosscut has been driven for 35 ft. without finding the footwall. The drift is 1,100 ft. below the lowest of the old workings on the Deadman vein and about 2,000 ft. below the outcrop. Development of the shoot has produced about 2,000 tons of ore, 680 of which was shipped to Tadanac and brought a net return of between $25 and $30 per ton; two cars of shipping ore, or about 80 tons, brought a return of about $100 per ton.

The mill is now treating about 60 tons per day, running on two shifts, but it will be speeded up to 100 tons in the spring, when more water will be available for power purposes. The capacity of the mill probably will be further increased in the fall, when it is expected that ample power from the West Kootenay Power & Light Company, which is extending its transmission wires to the mine, will be available.

Siscoe Mill Started

The first milling unit of Siscoe Gold, in the Rouyn district, Quebec, is now in operation. The mill will be tuned up and will be running to full capacity of from 100 to 120 tons per day at the end of the present month, with sufficient ore indicated to maintain operations at this rate for three years. The plant was designed and constructed by Southwestern Engineering, of Los Angeles.

Eureka Standard Will Install New Electric Hoist

A NEW electrical hoist is to be installed at the Eureka Standard mine, one mile south of the Tintic Standard mine, at Dividend, near Eureka, Utah. It will be a Wellman-Seaver-Morgan hoist, with 200-hp. capacity. The four-compartment shaft, now down 1,170 ft., will be deepened to 1,500 ft. for development of the new orebody opened up on the 1,000 level and recently struck on the 1,200. This orebody is entirely different from the deposits that have previously been mined in the Tintic district. It is a vein deposit in the Cambrian quartzite. Practically all of the district's output of $310,000,000 has come from the limestones of Middle Cambrian, Ordovician, upper Devonian, and Mississippian age.

The orebody, drifted on for 500 ft., carries gold, associated with pyrite, tetrahedrite, and some galena. Ore at present is being shipped direct to the Garfield smelter. The deposit, which on the 1,000 level was narrow, is widening out with depth.

Eureka Standard is owned by Tintic Standard Mining. James W. Wade is general manager. The Eureka Standard 780 level is connected with the 900 level of the Tintic Standard No. 2 shaft at Dividend.

Discovery of a large orebody in quartzite opens up a new field in the Tintic Standard. With a gold sulphide orebody in the Eureka Standard and a large part of North Lily production, 8,000 ft. northeast, coming from carbonate silver-lead orebodies in quartzite, companies are justified in prospecting quartzite showing strong mineralization.

Farmington Mill Burned

The Farmington mill of Dorothy Bill Mining, at Hockerville, Okla., in the Tri-State district, was totally destroyed by fire of unknown origin Jan. 6, with a loss of approximately $150,000. The plant was one of the largest in the district, having a capacity of 450 tons every ten hours. It will be rebuilt in the near future, according to C. C. Cole and J. R. Cole, of Tulsa, Okla., the owners of the property.

The same company recently purchased the Dobson mine of Federal Mining & Smelting. The Dobson mill is now undergoing rehabilitation, preparatory to an early opening.

Improvement Noted in Chilean Nitrate Industry

The recovery of the Chilean nitrate industry is reflected in large customs returns to the Chilean treasury, as is pointed out by the Chemical Division of the U. S. Department of Commerce. Chilean export duties for the first ten months of 1928 totaled 230,326,000 pesos, compared with 180,696,472 pesos in the same months of 1927. Of the first figure, 224,717,359 pesos came from nitrate exports.

Mining and Metallurgical Society Considers Human Engineering

"HUMAN Engineering," or the improvement of the social and economic condition of employees, formed the subject of several talks by well-known mining executives at the annual meeting and dinner of the Mining and Metallurgical Society of America at the Harvard Club, New York, on Jan. 10. Clinton H. Crane, president of the St. Joseph Lead Company, was the principal speaker. He contrasted present conditions at the company's properties in Missouri with those of a few years ago, before much attention was paid to pensions, group insurance, proper food, working conditions, and housing. In 1928, he said, among the 3,000 employees only 666 "separations" of a name from the payroll occurred, or a little over 20 per cent, compared with over 200 per cent ten years or so ago. Each separation, he considered, cost the company about $50. Group insurance was held largely accountable for the improvement in turnover.

Increased mechanization has been a feature of the underground work in southeast Missouri. This resulted, last year, in the 1,260 men employed in underground work producing an average of 14,150 tons of ore a day, or about three times as high a tonnage as ten years ago, with the same amount of labor. Improved housing, and the provision of a better milk supply, were other features of the company's work on which he dwelt. As to wages, Mr. Crane asserted that it was to a company's interest to pay high wages; that they would nearly always prove to be cheap wages in the long run.

Rodolphe L. Agassiz, president of Calumet & Hecla, then told what his company had done in Michigan toward the provision of housing, schools, churches, swimming pools, tennis courts, hospitals, and other desirable adjuncts to civilization. A pension scheme had been given attention, and also, in 1919, a group insurance plan by which every employee was granted a $1,000 policy, with a $100 increase for each year of service up to a maximum of $1,500. William Loeb, vice-president of American Smelting & Refining, then discussed briefly the pension schemes of his company, and other provisions for employee welfare, and R. M. Catlin, manager of the Franklin property of the New Jersey Zinc Company, told of the early days, and how the company gradually won the confidence and loyalty of its employees. A representative of the Metropolitan Life Insurance Company then discussed group insurance as the best plan yet offered for taking care of the families of old employees.

G. T. Bridgman was elected president of the society to succeed Clinton H. Crane, and he presided at the meeting.

Production From Dreamy Draw Expected to Start Soon

DISCOVERY of bodies of cinnabar ore in the Dreamy Draw mine, 9½ miles from Phoenix, Ariz., has caused officers of the Quicksilver Corporation of America to announce plans for further development of the mine and the start of commercial production of mercury within one month. E. W. Hartman, president and general manager, is to be in direct charge of development work.

This property consists of approximately 400 acres of land. Development thus far includes sinking a single-compartment shaft to the 150 level, building a power house, and installation of a 100-hp. Diesel engine, a 75-hp. generator, a compressor, and a 30-hp. electric motor.

The single-compartment shaft, which has now reached the 150 level, is 8 ft. wide on a 50-deg. incline and has been sunk the entire distance in ore, said to average 64 lb. of quicksilver to the ton. The corporation has installed one Hartman rotary furnace of 25 tons' daily capacity. A runway has been built from the crusher to the top of the retort, so that ores may be fed into the hopper by wheelbarrow.

New construction planned includes a complete assay office, sinking of a double-compartment shaft, building of general offices for the corporation, and installation of additional furnaces. Sam Hughes, original locator of the property, labored for eleven years sinking a shaft by hand. He worked to within a few feet of the vein, which the present operators uncovered.

Officers of the Quicksilver Corporation are E. W. Hartman, president and general manager; C. C. Hansen, vice-president and treasurer; and V. L. Hartman, secretary.

East Utah to Explore Holdings Near Park City

PREPARATIONS are being made by East Utah Mining to prospect the Hawkeye-McHenry east-west fault zone, east of the Park Utah mine, near Park City, Utah. A. H. Jones, formerly superintendent of mills for Tonopah Belmont Mining, is in charge of operations. Work has been started in the west drift, where a crosscut through the Hawkeye-McHenry fault will be driven in a northwest direction.

The Hawkeye-McHenry fault cuts the East Utah property into two parts. To the north of the fault the Park City formation is exposed and to the south the Weber quartzite. The property is equipped with a ten-drill Ingersoll-Rand compressor.

Mexican Mining Interests Ask Aid From President

A COMMISSION, representing mining interests throughout Mexico, is now preparing a petition, to be presented to President Portes Gil, asking for a general revision of federal taxes, import duties, and freight rates, to prevent the closing of many of the smaller properties. The low metal prices which have prevailed for the last two years for lead and zinc are principally blamed for the situation, but it is believed that a radical reduction in taxation and more favorable transportation rates might ameliorate the situation.

In a statement recently issued, the Mexican mining chamber pointed out the large number of properties which have recently been forced to close. Among those listed were: El Oro, Esperanza, Mina Mexico, and Alacran, in the State of Mexico; Piedra Bola, Espada, San Pedro Analco, and Plomozinc, in Jalisco; Velerdeña, in Durango; Calera, Corralitos, and Lamentos, in Chihuahua; San Juan Taviche and Natividad, in Oaxaca; El Tajo, in Sinaloa; Huigeras, in Coahuila; Pozos and Aurora Xichu, in Zacatecas; Campo Morado, in Guerrero; Cardonal, in Hidalgo; Asientos, in Aguascalientes and Ajuchitlan in Queretaro. The same statement points out that, although there were 31,000 patented properties in 1919, with a total extent of 446,549 hectares, at the end of 1928 there were only 15,513, covering an area of 222,174 hectares.

Cork Province Starts New Hydro-electric Plant

Cork Province Mines, operating in the Kaslo Creek district, British Columbia, put its hydro-electric plant into operation Jan. 11, and is now employing more men in development operations, to be in readiness for the starting of the mill. Remodeling of the mill is proceeding rapidly, and the plant will probably be in operation within the next few weeks. The mill, which will be entirely flotation, will have a capacity of 200 tons per day.

Whitehall Resumes Work

After a temporary shutdown, caused by replacement of some machinery, the Whitehall mine, near Fredericksburg, Va., has resumed operations, according to Alfred B. Iles, manager of Virginia Gold Mines, which is reopening the mine. The Millpond shaft is being deepened to the 125 level, from which point drifts will be run both north and south. A pilot mill will be operated on ore removed in development work.

A contract has been let for unwatering of the Dixter shaft, from which about $160,000 has been produced. The property has several other shafts and nine tunnels.

Rhéolaveur Process Involved in Merger

CONSOLIDATION of the American Rhéolaveur Corporation, of Wilkes-Barre, with the Koppers Company, of Pittsburgh, to form the Koppers-Rhéolaveur Company, has recently been announced. American Rhéolaveur was formed in 1925 to develop, in the United States, Canada, and Mexico, a process of cleaning coal and concentrating ore which has been used in Europe for several years. Although at first applied only to coal washing in this country, a plant using the process for the concentration of ore was installed in the Tri-State district and has been operating for several months. Preliminary results indicate marked improvement in recoveries and grade of concentrates, as well as a simpler and more easily maintained flow of materials through the mill.

United Verde Will Sink Two Shafts to 5,000 Level

UNITED VERDE COPPER has announced that within the year it will complete plans for deepening its two main shafts from the 3,000 level to 5,000 ft. One of the shafts will be sunk to a depth of 5,000 ft.; a drift will then be driven across to the other shaft, where a raise will be put up to the 3,000 level. The mine is at Jerome, Ariz.

About 60 per cent of the company's output, now more than 5,000 tons a month, is obtained from its underground operations. At 5,000 ft., the two shafts will be the deepest in the Southwest. The deepest shafts in the United States are in the Michigan copper district.

Great Western Is Leased

P. A. Stanley, secretary of Corona Mining & Milling, near Calistoga, Calif., is reported to have leased the Great Western quicksilver mine southwest of Middletown, Lake County, Calif. This property was formerly a large producer, but has not been operated since 1916. Work has already been started.

Lewiston Dredge Sold

Lewiston Dredging has sold its dredge to R. F. Lewis and L. K. Requa, of San Francisco. The dredge will continue in operation on the virgin ground of the company, which was also purchased by Messrs. Lewis and Requa. Other ground has also been acquired on the Trinity River. Lewiston Dredging was one of the H. P. Whitney companies. The dredge has been operated for about six years.

California Rand Orebodies Nearly Exhausted

THE only ore now available at the California Rand Silver mine, near Randsburg, Calif., is of very low grade, around $9 a ton, and with the decrease in ore values a decrease in earnings has naturally occurred, according to Alfred Harrell, president of the company. For this reason the regular dividend payments must be suspended. At present the property is operating without profit, and operations will be continued as long as discovery of new orebodies is considered possible.

At the same time the directors of the company have been looking for some other promising mining property, in the hope that the corporation might be perpetuated. With that in mind, an option has been taken on a lead-silver property, 48 miles from Yucca, Ariz., after an examination by W. T. Simpson, of San Francisco. Under the terms of the option, California Rand may take over the property within a year by payment of $35,000, with a 10 per cent interest to the original holders of the option, or acquire it in its entirety for $50,000. Equipment is being moved to the property from Randsburg for exploration purposes.

Silver King Wins Suit Over Water Rights

TITLE to 5½ second-feet of water flowing from the Spiro tunnel of Silver King Consolidated at Park City, Utah, has been granted to the company by District Judge M. L. Ritchie. The suit was brought by the company against the State of Utah, and several farmers were also made defendants. The waters, the decree held, are developed waters and therefore not public waters. A small part of the flow from the tunnel, which is fed by waters encountered nearer the tunnel portal, was conceded to be surface water. This cannot be sold or leased, but must be allowed to flow from the tunnel.

Gypsum Tariff Discussed

THE question has been raised before the Bureau of Customs as to whether crushed gypsum is on the free list as crude gypsum, dutiable at 30 per cent ad valorem as a partly manufactured mineral, or at $1.40 per ton as ground gypsum. In hearings on Jan. 10 the producers asked for duties of $3 per ton on crude, $3.50 on crushed, and $4.25 on calcined gypsum, contending that interests, especially in New York State, were being forced out of business by Canadian mines possessing the advantage of cheap mining and water transportation. Manufacturers of gypsum materials, however, wished gypsum to go on the free list. They argued that a tariff increase would benefit a few producers in a limited area at the expense of a widespread materials industry.

Metal-Mine Operations in Western States in 1928

As Summarized by the U. S. Bureau of Mines

Arizona Output Higher With Better Copper Prices

VALUE of the gold, silver, copper, lead, and zinc produced in Arizona in 1928 was $116,462,000, an increase from $98,790,957 in 1927, according to estimates by the U. S. Bureau of Mines. The increase in copper was marked and there was a slight increase in silver, but the gold, lead, and zinc decreased as compared with the totals of 1927.

Gold output decreased from $4,144,591 in 1927 to about $3,930,000 in 1928 in spite of the increase in gold recovered from copper bullion. The output of the Katherine mine, in the Union Pass district, Mohave County, was only about half that of 1927, and gold from the San Francisco (Oatman) district was decidedly less. Nine companies produced more than $100,000 worth of gold, each, in 1928—United Verde, Copper Queen, Calumet & Arizona, New Cornelia, Magma, United Verde Extension, Katherine, the Morenci branch of the Phelps Dodge Corporation, and the Tom Reed properties. Considerable gold was also produced from Shattuck Denn, Old Dominion, the Bunker Hill group at Tombstone, the MacNeill mine, a producer of lead ore in Maricopa County, and the Commonwealth properties.

The silver output increased from 6,847,680 oz. in 1927 to about 6,943,000 oz. in 1928, and the value from $3,882,635 to about $4,062,000. United Verde continued to lead all other mines in the state as a silver producer. It has greatly increased its output since the new flotation mill started early in 1927. Other large producers were the Calumet & Arizona, Magma, Copper Queen, United Verde Extension, New Cornelia, Bunker Hill, Morenci branch of the Phelps Dodge Corporation, Shattuck Denn, and Old Dominion mines.

Copper production increased from 682,190,547 lb. in 1927 to about 736,282,000 lb. in 1928, and the value from $89,366,962 to about $107,497,000. The output of Calumet & Arizona, United Verde, Copper Queen, Ray, New Cornelia, United Verde Extension, Magma, and Shattuck Denn mines was decidedly increased. Production of copper from ore leached at Inspiration, United Verde, and New Cornelia was also greater. As in 1927, eight copper smelting plants within the state were active throughout the year, but the plant at Humboldt was idle. Despite favorable conditions in 1928, production from Morenci, Old Dominion, Miami, Arizona Commercial, and Inspiration was less than in 1927. Mines, in addition to those mentioned, that produced more than 1,000,000 lb. of copper each were the El Tiro, Christmas, and De Soto properties. A notable increase in copper was made at Copper Queen, United Verde, and New Cornelia properties as a result of work at their flotation mills. A new 300-ton mill was completed at Jerome for the Verde Central mine.

The lead production in Arizona decreased from 19,865,961 lb. in 1927 to about 14,767,000 lb. in 1928, and the value from $1,251,556 to about $901,000. Copper Queen took first place as the largest lead producer in Arizona, and it was followed by the MacNeill mine of Tonopah Belmont Development in Maricopa County, and the Montana mine in Santa Cruz County. Other large producers were Shattuck Denn, Seventy-nine, Calumet & Arizona, New Dominion, Martinez, and Bunker Hill. The Montana mine, at Ruby, became a large producer of both lead and zinc in September, after a 250-ton flotation mill was completed by Montana Mines Operations. The new lead smelter of Phelps Dodge, at Douglas, was operated throughout the year, treating much lead ore and concentrate that formerly went to El Paso, Tex.

Output of zinc recovered chiefly from mines in Santa Cruz County during the last quarter of the year decreased from 2,268,960 lb. in 1927 to about 1,200,000 lb. in 1928, and the value from $145,213 to about $72,000. The large decrease in zinc was due to the curtailment of lead-zinc shipments by Calumet & Arizona. Arizona Hillside Development was idle and few zinc products were shipped from Mohave County. The new flotation plant at the Montana mine, at Ruby, was worked regularly for four months on lead-zinc ore. Lead concentrate and zinc concentrate were shipped to Texas for treatment.

Increase in New Mexico Metal Output in 1928

ESTIMATED output of gold, silver, copper. lead, and zinc from New Mexico ores in 1928 was 31,546 oz. of gold, 822,478 oz. of silver, 14,462,000 lb. of lead, 88,214,000 lb. of copper, and 65,658,000 lb. of zinc, according to the U. S. Bureau of Mines. These figures show substantial increases in all metals except silver and lead, for which there were decreases, respectively, of 67,600 oz. and of 1,591,000 lb. The estimated gross value of the New Mexico metal production is: gold, $652,114, silver $481,150; lead, $882,182; copper, $12,879,244, and zinc, $3,939,480, or a total of $18,834,170, compared with $15,662,076 in 1927.

The Pecos mine, operated by American Metal in San Miguel County, showed a marked increase in production over the production in 1927. The mill has a capacity of 600 tons a day and employs selective flotation. In 1928 it produced 55,850 tons of zinc concentrates and 16,540 tons of lead concentrates.

Copper has the greatest total value among the metals. The Chino mines of Nevada Consolidated, at Santa Rita, were operated steadily, but not at full capacity. Ore treated in 1928 was almost entirely from shovel operations, but the development for the future underground mining of the Estrella orebody was continued. The Lordsburg district produced about the same tonnage of siliceous copper-gold-silver ores as it did in 1927, when it shipped 93,406 tons of ore, yielding in recovered metals 9,546 oz. of gold, 77,155 oz. of silver, 3,933,496 lb. of copper, and 46,381 lb. of lead. It was shipped to smelters at Douglas, Ariz., and El Paso, Tex., where it was used for furnace linings in copper smelting furnaces. Special leaching experiments by the Burro Mountain branch of the Phelps Dodge Company, at Tyrone, were continued for part of the year and leaching of the 1,000,000-ton waste dump was continued during 1928. Hanover-Bessemer Iron & Copper, at Fierro, shipped several thousand tons of copper ore to El Paso, Tex., and several hundred thousand tons of iron ore to the steel plant at Pueblo, Colo. Copper carbonate ores were shipped from Pastura, Guadalupe County, and Scholle, Torrence County. Manganiferous-iron ore from Silver City shipped to the steel plant at Pueblo, Colo., totaled 60,000 short tons.

Gold placers at Pinos Altos, Grant County, and on Ute Creek, Colfax County, the Aztec lode mine at the base of Mount Baldy, Colfax County, and the Gold Hill district, Hidalgo County, contributed gold bullion. Silver ores were shipped from Chloride, Fairview, Lake Valley, and Kingston, Sierra County. In addition to the lead concentrates shipped by the Pecos mill, in San Miguel County, lead ores were shipped from the Organ Mountain, Hachita, Hanover, Florida Mountains, Los Cerrillos, Steins, and Kelly-Magdalena districts.

Zinc production was from the Deming, Glorieta, Hanover, Kelly, Los Cerrillos, and Pinos Altos districts. The Empire Zinc flotation mill, at Hanover, was operated throughout 1928. The Ozark flotation mill at Kelly and the Carnahan Mines flotation mill, at Golden, were idle in 1928. Peru Mining, a subsidiary of Illinois Zinc, continued operation of its Peru mine, at Hanover, and after March operated its newly constructed 100-ton flotation plant at Deming, both on its own ore and custom ore. The new Black Hawk 100-ton selective flotation mill, at Hanover, which started operations on Aug. 1, 1928, treated zinc-lead ores from the Lucky Bill group.

Copper Accounts for Most of Large Nevada Gain in 1928

VALUE of gold, silver, copper, lead, and zinc in Nevada increased from $23,322,589 in 1927 to about $31,184,000 in 1928, according to a preliminary statement prepared by the U. S. Bureau of Mines. A decided increase in the output of copper and gold is recorded and a slight increase in silver, but the output of lead and zinc decreased slightly. The increase in copper was equivalent to about $7,400,000, which accounts for most of the increase in the total value of the metal output of the state.

Gold output increased from $3,107,931 in 1927 to about $3,570,000 in 1928, chiefly on account of the enlarged output of copper ore from the mines at Ely. Nevada Consolidated was by far the largest producer of gold in Nevada in 1928. It was followed by the Elkoro property, at Jarbidge; Consolidated Coppermines, at Kimberly; the Goldfield Consolidated tailings dump, at Goldfield; Gold Circle Consolidated, at Midas; Tonopah Mining at Tonopah; Flowery, at Virginia City; White Caps, at Manhattan, and the Round Mountain, Tonopah Extension, and Tonopah Belmont mines. The largest increases in gold output were made by Nevada Consolidated, Goldfield Consolidated tailings, Elkoro, Consolidated Coppermines, Gold Circle Consolidated, and Tonopah Mining. Decreased production was reported by the San Rafael, White Caps, Tonopah Extension, Flowery, and Tonopah Belmont companies. Gold was also recovered at many new or rejuvenated mines such as the Basque, Gold Basin, Rochester Canyon, Oromonte, and Olympic properties.

Silver production increased from 5,397,179 oz. in 1927 to about 5,401,000 oz. in 1928, and the value rose from $3,060,200 to about $3,160,000. Consolidated Cortez, south of Beowawe, was the largest silver producer in the state, followed closely by Tonopah Mining. Next in rank were Betty O'Neal, Tonopah Extension, Bristol Silver, Tonopah Belmont, West End Consolidated, Tonopah Divide, Rochester Silver, Elkoro, and Nevada Consolidated. Decreases in production were reported by Betty O'Neal, Tonopah Extension, and San Rafael companies, but Consolidated Cortez, Bristol Silver, Tonopah Mining, Elkoro, Rochester Silver, and Combined Metals Reduction reported increases.

Copper output increased from 120,259,276 lb. in 1927 to about 158,577,000 lb. in 1928, and value increased from $15,753,965 to about $23,152,000. Nevada Consolidated Copper, operating its mine, mill, and smelter at Ely and McGill, was by far the largest producer and increased its output more than 30,000,000 lb. Improvements at both mill and smelter have resulted in a much better recovery. The mine will soon be worked by a new five-compartment shaft. Other large producers that increased output were Consolidated Coppermines Corporation, at Kimberly; Mason Valley Mines, at Mason; Bristol Silver Mines, at Pioche; and Copper Canyon, at Battle Mountain. Mason Valley Mines ran its smelter at Thompson the entire year. The plant received custom ore from Nevada and California, but most of the copper recovered came from the Bluestone and Mason Valley mines near Mason.

Lead output decreased from 15,784,818 lb. in 1927 to about 15,117,000 lb. in 1928, and the value from $994,444 to about $922,000. Bristol Silver, at Pioche, became the largest producer of lead, as well as a large producer of silver and copper, followed by Combined Metals, also at Pioche, and the Yellow Pine mine, at Goodsprings. Other large producers were the Panther, Richmond Eureka, Nevada Lead & Zinc, Black Forest, and American Beauty properties. The San Rafael property, near Fallon, the second largest producer in 1927, was being further developed, and the Eureka Holly mine was idle. Increases were made by Bristol Silver, Combined Metals, Yellow Pine, Panther, and American Beauty. Late in the year, a new flotation plant was under construction at the old Tybo mine, in Nye County.

Zinc recovered from ore mined in Nevada decreased slightly from 6,344,523 lb. in 1927 to about 6,333,000 lb. in 1928, and from $406,049 in value to about $380,000. Combined Metals Reduction nearly doubled its output of zinc from property at Pioche, but output from Yellow Pine, at Goodsprings, was considerably less, as shipments ceased in June.

Utah Production in 1928 Shows Large Gain Over 1927

MINES of Utah in 1928 produced gold, silver, copper, lead and zinc valued $79,722,000, an increase of about $6,096,300 over the 1927 record, according to estimates of the U. S. Bureau of Mines. A marked increase was reported in copper and gold, but the output of silver, lead, and zinc was less than in 1927. The smelting plants at Murray, Midvale, Garfield, and International were active. A new plant designed to leach copper from waste dumps was completed at the mouth of Bingham Canyon by Utah Copper.

Gold production increased considerably from $4,008,451 in 1927 to about $4,301,000 in 1928. As in recent years, practically all the gold was recovered from ores and concentrates smelted. In general, the mines in the Bingham district, especially Utah Copper, showed a marked increase in the output of gold, and gold from the Tintic district was greater, but Park City showed a large decrease. The Deer Trail mine, near Marysvale, a large producer of gold from 1918 to 1924, was operated in 1928 by U. S. Smelting, Refining & Exploration. The largest producers were Utah Copper, Park Utah Consolidated, United States, Utah-Delaware, Eureka Lilly, Utah-Apex, North Lily, and Tintic Standard. Pronounced increases were made by Utah Copper, Eureka Lilly, North Lily, Deer Trail, Bingham Metals, Bluestone (Stockton Lead), and Live Yankee. Ore shipped from the Eureka Standard mine, a new producer in the eastern part of the Tintic district, was chiefly valuable for its gold content.

Silver output decreased from 18,606,950 oz. in 1927 to about 16,682,000 oz. in 1928. Value of the silver output decreased from $10,550,141 to about $9,759,000. Tintic Standard Mining was the largest producer of silver in Utah in 1928. It was followed closely by the Park Utah Consolidated Mines and Silver King Coalition. Next in order came Utah Copper, United States, Bingham Mines, Ontario, North Lily, Utah - Delaware, Chief Consolidated, Plutus, Utah-Apex, New Quincy, Mammoth, and Eureka Lilly. In August, development work was started by American Smelting & Refining at the old Silver Reef property near St. George, Washington County.

Copper increased from 256,933,278 lb. in 1927 to about 290,044,000 lb. in 1928, the largest production ever recorded from the state. Value increased from $33,658,259 to about $42,346,000, as a result of the increased price. Utah Copper at Bingham, responding to the increased price of copper, produced 19,360,000 lb. of copper a month the first half of the year, increased the rate of production to 23,905,488 lb. of copper a month the third quarter of the year, and made an even better record in the fourth quarter. Improvements at the Arthur and Magna mills brought the combined capacity up to more than 50,000 tons of ore a day, and at the mine electric shovels were installed to replace steam shovels. Copper recovery in concentrate was increased to nearly 90 per cent and the grade of the concentrate was greatly improved, especially after dropping the iron. Output from mines of Park City district increased slightly. In the Tintic district the decrease in copper was general, although the Tintic Standard, the largest copper producer in the region, upheld its output.

Lead output decreased from 302,570,040 lb. in 1927 to about 286,792,000 lb. in 1928, and the value fell from $19,061,913 to about $17,494,000, as the average price declined. Lead smelting plants were active, but not worked to capacity, although bullion shipments from Murray were increased. Increased shipments of ore and concentrate were reported from Silver King Coalition, where mill capacity was increased by addition of flotation equipment. North Lily, east of Eureka, more than doubled its output, and Utah Copper became an important producer of lead from lead-zinc ore treated at a custom flotation plant. Three large custom flotation plants were operated continuously, as well as the Chief Consolidated mill at Eureka, the Utah-Apex plant at Bingham, and the improved Silver King Coalition mill at

Park City. The Park Galena mill, near Keetley, made a lead-zinc middling, from which lead and zinc products were separated by flotation. The Park City district showed a good increase in lead, as did the Rush Valley district of Tooele County, but the lead output from the Tintic, Bingham, and Big and Little Cottonwood districts was less. The largest producers of lead in order of output were Park Utah Consolidated, Silver King Coalition, Tintic Standard, United States, Utah-Delaware, North Lily, Utah-Apex, Bingham Mines (including Victoria), Bullion Coalition, Plutus, Eureka Lilly, and Bluestone. The Eureka Lilly mine, adjoining the Tintic Standard property, became a large producer of silver-lead ore, most of which was milled in the Chief mill at Eureka. Equipment was installed to renew operations at the old Bullion Beck mine, at Eureka, new ore was found in the Plutus mine, and new mills were erected at the Hill Top mine, near Dunbar, and the Prince of Wales property, in Big Cottonwood Canyon.

Zinc production, recovered chiefly from concentrate leached or smelted, decreased slightly from 99,185,443 lb. in 1927 to about 97,034,000 lb. in 1928. The value decreased from $6,347,868 to about $5,822,000. All the large flotation mills in Utah treating lead-zinc ore were operating in 1928, but they were not all worked at full capacity. At Park City there was a general increase in zinc output. At Bingham some of the mines reported less zinc, but output from other mines increased. Zinc recovered from Utah Copper lead-zinc mill ore was doubled. Comparatively little zinc came from the Tintic district, but the Alaska property produced some lead-zinc mill ore. The largest zinc producers were the Park Utah Consolidated, United States, Silver King Coalition, Utah-Delaware, Utah-Apex, New Quincy, Utah Copper, Ontario, Utah Metal & Tunnel, Bullion Coalition, and Galena King mines.

South Dakota Produces Less

METAL mines in South Dakota in 1928 produced $6,615,000 in gold and 89,000 oz. of silver, according to the U. S. Bureau of Mines. This compares with production in 1927 of $6,656,987 in gold and 96,171 oz. of silver. The Homestake mine, the largest gold mine in the United States, produced slightly less than in 1927. Other producers in 1928 were Keystone Consolidated Mines, near Keystone, which shipped bullion to the Denver mint and concentrates to the Golden Cycle mill, at Colorado Springs, Colo., and one placer mine near Tinton, which made a small shipment of bullion to the Denver mint.

Trojan Mining, in October, 1928, reopened the Trojan mine, formerly an important producer of low-grade gold ore, treated by cyanidation, but idle since 1923. Production from the property is not expected to start until sometime in the spring of 1929.

Increase in Copper Shown in Montana's 1928 Output

VALUE of gold, silver, copper, lead and zinc produced from Montana mines in 1928, according to estimates by the U. S. Bureau of Mines, was $56,055,000, an increase from $49,265,925 in 1927. The improvement in the market for copper resulted in a large increase in production of the metal and also in the total value of the metal output of the state.

Gold production increased from $1,106,796 in 1927 to about $1,296,000 in 1928. The largest gold producers were Anaconda, Liberty Montana, Spring Hill, New Gould, St. Louis, Butte & Superior, Butte Copper & Zinc, and Piegon-Gloster. The new cyanidation plant of the Montana-Idaho Mines Corporation started milling ore from the Spring Hill mine in February, and the property became the third largest gold producer. Liberty Montana Mines operated its mine and mill near Jefferson Island throughout the entire year, making an important production of copper concentrate chiefly valuable for its gold content. Gold recovered from the ore of the Drumlummon mine, at Marysville, a large gold producer in recent years, was decidedly decreased.

Mine output of silver decreased from 11,200,077 oz. in 1927 to about 10,726,000 oz. in 1928, and the value from $6,350,444 to about $6,275,000. In general, the output from the Butte mines was slightly less than in 1927, as shown in statements of Butte & Superior, East Butte, North Butte, and Moulton. However, an increase was shown by the Elm Orlu, Emma, Ardsley Butte, and Otisco mines. As usual, Anaconda Copper surpassed all other Montana mining companies in silver production; Butte & Superior was second. Next in order were Elm Orlu, Butte Copper & Zinc, East Butte, and Poser, at Butte; the Silver Dyke mine, at Neihart, and the Ardsley Butte property, at Butte. Considerable silver was recovered by flotation from the Granite Bimetallic tailing dump and from lead-zinc ore of the Silver Prince mine, both at Philipsburg.

Copper output increased from 223,492,639 lb. in 1927 to about 248,571,000 lb. in 1928, and the value from $29,277,536 to about $36,291,000. Anaconda Copper, as in the past, produced most of the state's copper from its mines at Butte. East Butte was next. North Butte, formerly a large producer, was idle.

Other large copper producers were the Anselmo, Butte & Superior, and Elm Orlu mines, at Butte, and the Silver Dyke property, at Neihart. Aside from the Silver Dyke output, Liberty Montana, and various small mines, all the copper ore was mined at Butte and milled or smelted at the Anaconda company's plants at Anaconda.

Production of lead decreased from 35,898,315 lb., valued at $2,261,594, in 1927, to about 32,662,000 lb., valued at about $1,993,000, in 1928. The chief producers were Butte Copper & Zinc, Butte & Superior, Poser, and Elm Orlu, at Butte; Silver Dyke, at Neihart; and Butte Copper Consolidated, at Radersburg. Each of these produced more than 1,000,000 lb. Other producers were the Otisco, Commonwealth, Anaconda, and Galt mines. Considerable lead-zinc ore from the Queen mine, at Neihart, was treated in the Timber Butte mill, at Butte, and similar ore from the Silver Prince and Trout mines, at Philipsburg, produced much lead. A new mill was completed for the Block P. mine, in Judith Basin County, controlled by St. Joseph Lead. The lead smelter at East Helena was operated regularly, but shipments of lead bullion were less than in 1927.

Zinc output increased from 160,461,803 lb. in 1927 to about 170,000,000 lb. in 1928, but value decreased from $10,269,555 to about $10,200,000. The electrolytic zinc plant near Great Falls was operated continuously, treating concentrate from Anaconda and Butte and custom material chiefly from Idaho and Utah. The new electrolytic plant at Anaconda was completed and operated from March to the end of the year, making more than 4,000 tons of slab zinc a month. Nearly 85 per cent of the total output of zinc was produced from four properties at Butte. These included Butte & Superior, Elm Orlu, Butte Copper & Zinc, Poser, Otisco, and Anaconda. Increases were made at Elm Orlu, Butte Copper & Zinc, and Otisco, but large decreases occurred at Butte & Superior, Poser, North Butte, and Moulton. Considerable zinc ore was milled from the Silver Prince, Queen, Galt, Trout, Iron Mountain, and Comet mines, outside the Butte district. The custom flotation plant for lead-zinc ore was active at Anaconda, and the Timber Butte custom mill, at Butte, continued to treat custom ore and ore from the Elm Orlu and other Clark properties. Much of the increase in zinc output was the result of the treatment of slag at East Helena in the fuming plant of Anaconda Copper.

Texas Metal Output Increases

IN TEXAS in 1928 metal mines produced $12,000 in gold, 1,391,000 oz. of silver, 877,000 lb. of lead and 316,000 lb. of copper, according to the U. S. Bureau of Mines. This compares with the 1927 production of $8,192 in gold, 1,034,866 oz. of silver, 487,984 lb. of lead, and 21,458 lb. of copper. The Presidio mine, operated by American Metal, contributed the greater part of the state's production. This mine has been a consistent producer since 1885, and the 1928 production was the largest in its history.

Shipment of dump material, containing silver, copper, and lead, from the Hazel mine to El Paso continued in 1928. World Exploration started underground development work at this property in 1928. The Mohawk mines also continued shipments of copper-silver ore to El Paso in the year just closed.

Oregon 1928 Metal Output Lower Than in 1927

ESTIMATED total value of the gold, silver, copper, and lead produced in Oregon in 1928 was $261,000, according to the U. S. Bureau of Mines, as compared with $393,657 in 1927, or a decrease of 34 per cent. Gold produced in Oregon in 1928 is estimated at 10,150 oz., valued at $209,800, a decrease of 31 per cent as compared with 1927. With the completion of new plans and the addition of a dredge, Oregon gold mining for 1929 is promising. The yield of silver is estimated at 21,700 oz., valued at $12,700, a decrease of 53 per cent in quantity and of 51 per cent in value, compared with 1927. Copper produced in 1928 is estimated at 265,000 lb., valued at $39,000, compared with 488,200 lb., valued at $63,954, in 1927. The lead output in 1928 was a byproduct and amounted to about 6,000 lb., compared with 5,300 lb. in 1927.

Metal mining in eastern Oregon in 1928 was characterized by refinancing and exploratory activities which foreshadowed increased production in 1929. Development of the Mother Lode copper belt was continued throughout the year, and much new surface equipment was installed by Oregon Copper. Homestead Iron Dyke, however, was idle, as were the Cornucopia properties, in northeastern Baker County. The Superior dredge was equipped with new machinery, and dredging began late in 1928. Connor Creek Mining was driving tunnels and blocking out ore at its property near Home, and the Gleeson mine, at Lime, was taken over by Washington interests. No ore was mined from the Bonanza, near Whitney, though shipments of bullion were made from the Resolute, an adjoining property. Milling and drifting were done at the Rabbit mine, and a mill at the Banner was completed, both near Whitney.

In Grant County, operations under new management were resumed at the La Bellevue. A mill was installed at the Monumental property and shipments of ore were begun. Drifting on the Mayflower tunnel was done. Development work and production were reported for the Buffalo Monitor. Empire Gold Dredging moved its dredge to Prairie City late in the year and contemplated resumption of operations early in 1929. The Yakima-Badger property produced at intervals.

The tunnel at the Continental property, 12 miles from Myrtle Creek, Douglas County, was completed. The Silver Peak mine, near Riddle, idle in 1927, was developed, and copper ore was shipped to the smelter in 1928. In Curry County the Robert E Mine began production in July and was a large contributor to the gold output of the state. A new dredge was constructed by Rogue River Gold, to operate on Foots Creek, and production began late in the year. The old Layton hydraulic mine was operated as usual.

In Josephine County the Robertson mine, an important gold producer in 1925 and 1926, was taken over by Portland interests late in the year. The Sugar Pines mines, in the Galice district, were developed, and production is expected to begin in March, 1929. Oregon Metal Corporation ceased work at the Jewett mine, near Grants Pass, and dismantled its mill. Lack of water early in the year curtailed operations at the Swastika. At the Osgood, a new ditch to the property was constructed for 1929. Development work at the Llano de Oro hydraulic mine resulted in a somewhat decreased output, compared with 1927.

Idaho Reports Declined Production in 1928

THE total value of the gold, silver, copper, lead, and zinc produced in Idaho in 1928, according to estimates by the U. S. Bureau of Mines, was about $27,231,000, as compared with $28,104,413 in 1927. The output of gold increased considerably, and there was also an increase in the output of zinc, but silver, copper, and lead decreased.

Gold output in 1928 was valued at about $410,000, compared with $316,603 in 1927. The increase in the output of gold from the Idawa property, near Centerville, was notable, and the mine became the largest producer of gold in the state. South Park Dredging, at Featherville, the largest producer in 1927, increased its output in 1928, but dredge operations ceased in June. Gold Dredging & Power Corporation, at Centerville, was the third largest producer. Considerable gold was also produced by Mackay Metals, at Mackay; Boise Placer, at Idaho City; and the Lincoln mine, at Pearl. The Gold Hill & Iowa mine, at Quartzburg was unwatered by Talache Mines.

Silver output decreased slightly from 8,901,409 oz. in 1927 to about 8,811,000 oz. in 1928, but the value increased from $5,047,099 to about $5,154,000, on account of an increase in the average price of silver. In the Coeur d'Alene district, which produced at least 8,300,000 oz. of silver, about 75 per cent of the product was recovered from the ores of the four largest producers, the Hecla, Morning, Bunker Hill & Sullivan, and Sunshine mines. The Gold Hunter, Tamarack & Custer, Strattons, and Crescent mines were also large producers, and the Page, Triumph, Sherman, Galena, and Caledonia properties followed. The Sunshine property, east of Kellogg, upheld its remarkable record of 1927; the flotation plant was worked regularly, producing a copper-lead concentrate. Several shipments averaged as high as 800 oz. of silver to the ton. Considerable silver was recovered from mines that have become producers in recent years, such as the Triumph (Blaine County), Whitedelf, Galena, Wilbert, Jack Waite, Page, and Black Hawk properties. The Crescent mine, near Kellogg, was again an important producer of silver after the mill, which was burned in 1927, was rebuilt. The Caledonia mine, although practically exhausted, continued to supply a good production of silver.

Copper production decreased from 2,173,163 lb. in 1927 to about 2,117,000 lb. in 1928, but the value increased from $284,684 to about $309,000, as the average price of the metal increased. Mackay Metals, formerly Idaho Metals, was the largest producer in Idaho in 1928, although it did not begin shipments until August. Other producers were the Hecla, at Burke; Winder-Stillman (Pope Shenon), in Lemhi County; and the Sunshine and Crescent properties, east of Kellogg. Only an occasional shipment was made from the Harmony property, near Baker.

Lead output decreased from 302,038,423 lb. in 1927 to about 290,753,000 lb. in 1928, and the value from $19,028,421 to about $17,736,000. Bunker Hill & Sullivan, Morning, and Hecla were as usual the three largest producers. Golconda Lead completed its 200-ton flotation plant in July and started shipments of lead and zinc concentrates in August. The three leading producers were followed by the Page, Tamarack & Custer, Gold Hunter, Strattons, Jack Waite, Galena, Sidney, Sherman, Golconda, Triumph, Wilbert, Hayes, Black Hawk, United Idaho, and Livingston properties. Considerable lead was recovered from the Bunker Hill tailing dump, near Kellogg. New mills were erected by Cedar Creek, Lookout, Whitedelf, Dickens, and Hall-Interstate.

Zinc recovered from ore and concentrate increased from 53,556,345 lb. in 1927 to about 60,360,000 lb. in 1928, and the value from $3,427,606 to about $3,622,000. No shipments were made from the Douglas or Highland-Surprise mines. Most of the zinc output was recovered by roasting and leaching at Great Falls and Anaconda, Mont. About 5,000 tons of high-grade zinc concentrate was shipped monthly from the Coeur d'Alene region. The Morning mine produced more zinc than all the other mines combined. Next in order were the Sidney, Tamarack & Custer, Triumph, Frisco, Page, Golconda, Humming Bird, Livingston, and Bunker Hill & Sullivan properties. Considerable zinc was also recovered from old tailing deposit in Canyon Creek, northeast of Wallace. In June, Livingston Mines, operating south of Mackay, made a separate zinc product as well as a lead concentrate. Both products were shipped to Midvale, Utah, either for smelting or remilling. The new electrolytic zinc plant of Sullivan Mining, near Kellogg, was completed and operated late in 1928 on zinc concentrate previously stored. In anticipation of this interesting event the Star mine, east of Wallace, made no regular shipments of lead-zinc ore. A large output of lead concentrate and zinc concentrate was shipped to Montana, from March to December, from the Hercules custom flotation plant at Wallace.

Reviews of operations in Colorado, California, and Washington will appear in the Feb. 2 issue.

MARKET AND FINANCIAL NEWS

Activity in Mining Shares Attracts British Investors

By W. A. Doman
Editor "The Financial Times," London

London, Jan. 8, 1929 — Speculators on this side are still keenly watching market developments in New York, both as regards industrials and mining shares, and are making purchases wherever a profit seems to be indicated. The greatest interest is in Mond Nickel, shares in which of a normal value of 10s. being rushed up to over £11. Two parties are connected with the activity; one argues that it is legitimate to discount the future and to deal as though the ore developed were already on its way to the smelter, whereas the other looks at things in a cold light and shakes its head. Meantime, many bank balances have been increased handsomely.

In various quarters a discussion has taken place as to who are the purchasers of Northern Rhodesia copper mining shares. Their advances, to which reference has been made on previous occasions, were attributed to American buying. Some persons claim to be able to analyze the position, and in their view transatlantic operations have been on a small scale only. Where, then, have the shares gone that have been sold? The suggestion is that they have been put into the recently formed Rhodesian Anglo-American Trust, and as American capital is in this trust, so shares have been bought "on American account." The rise in industrial and mining shares in New York is supposed to be reflected on this side. In connection with the advance in copper, it is interesting to note that Rio Tinto shares are now quoted at 63. This revives the old saying that Tinto stands or should stand at the same price as copper itself. Whether this holds good now remains to be seen, as the company has various interests, and is less concerned with copper than in the past.

The advance in the price of copper on the other side has suggested that America is buying, or will buy, copper shares under London control. The latest company to be roped in in this way is Burma Corporation. Announcement has been made that large blocks of the shares have been bought for transfer to New York, and within the last fortnight the price has risen from 16s. to 20s.6d.

The return at the current price is low for a mining share, but where there is the chance of a gambling profit, yield is ignored. However, the ore reserves of the Burma Corporation are so extensive that amortization need not immediately enter into the question of purchase. Not that the ordinary purchaser of mining shares ever does put amortization into practice, but he sometimes likes to talk about it.

San Francisco Mines of Mexico are also, if rumor be correct, to be listed on the New York market, and with this possibility in view the price has advanced in the last fortnight from 30s. 6d. to 35s. Quite apart from curb listing, the rise in the price of metals would explain much of the improvement.

A queer rumor is current as to the formation of an international syndicate to deal with base metals; it is to have representation, says the Jade, in Paris, Brussels, London, and New York. This matter reached me from a really good source, from a merchant dealing largely in metals, but not connected with the international syndicate. Inquiries made at different offices where such a movement should be known have drawn blanks, except a whisper at one place that the move may be connected with Northern Rhodesia copper shares.

Optimists in the tin world are looking for a price during the current year of £300 a ton again, and some of them are basing their profits on that figure. Three Malayan tin companies are about to combine — Rawang, Serendah, and Serendah South. The properties adjoin, and the estimated yardage is 130,000,000 cu.yd., varying in content from two-thirds to 1½ lb. of tin oxide per cubic yard. Rawang's capital is to be increased to £1,000,000 in 10s. shares, of which 1,752,000 will be issued—960,000 to Rawang Tin, 396,000 to Serendah Tin, and 396,000 to Serendah South.

German Aluminum Producing Industry Progresses

By Dr. James Rubinfeld
Special Berlin Correspondent

The production of aluminum foil in Germany has greatly expanded during recent years and is gaining in importance, not only as a fully adequate substitute for tin foils but also in several wholly new applications. Aluminum foil is less toxic than its older competitor and is more hygienically fabricated by thorough annealing and the elimination of rolling-oil traces. Moreover, aluminum being cheaper by two-thirds or so for the same volume, it is finding almost universal application in the packing, furniture, and cosmetic fields in Germany. Its output now equals that of aluminum for kitchen utensils and may absorb from a tenth to a seventh of the German raw aluminum production. Production of aluminum foil in Germany alone is believed to be approximately four-ninths of the world output. Some aluminum foil is finished, painted, shaped, and applied as a brilliant wallpaper in several patterns, and recently efforts have been made to develop it as a cloth for ballroom arrangements; as upper leather substitutes for ladies' shoes; as a film material with celluloid cover, and in other ways. The low price (a square meter costs only 10 pfennige, or 2½c.) is of course a stimulus for such experiments, which, in my opinion, may later revolutionize many branches of industry. The most important producers and finishers of the material are the two factories of the Swiss Neuhausen firm situated in Badenia. Aluminum foil also finds important outlets in Far Eastern countries, especially in China.

Another feature of recent months has been the larger offerings of cadmium in Europe by the Consolidated Mining & Smelting Company of Canada, as well as by Anaconda. Some surprise is being expressed because the Giesche's Heirs, who, previous to the World War, almost controlled the European cadmium market, with a yearly production of 50 to 60 tons, are now being ousted by their American friends, while Australian cadmium has a fairly firm hold on British markets. From the Continental standpoint it is regarded as unfortunate that cadmium should gain importance as a plating metal just when Giesche's production of zinc oxide, from which its cadmium production is derived, in old-fashioned furnaces (such as the Pauls Smelter of Giesche Spolka), has been much reduced through the general renovation going on there. People wonder what will be the price tendency of cadmium in the future

in view of the international cartellization of zinc by the Brussels Syndicate, which includes the Australian as well as the Canadian interests. Giesche's present output of cadmium is estimated at some ten tons yearly.

About three months ago a central sales agency, formed under the name "Mercurio Europeo," by Spanish and Italian quicksilver producers, at Lausanne, Switzerland, caused a reduction of the then inflated London price of quicksilver by some £2. News to the effect that the sales agency will remove its seat to London has been circulated, but I am informed that this rumor is without foundation and arises from the fancy of speculators who are holding stocks of quicksilver accumulated at inflated prices. Mexican quicksilver interests are said to have been in some touch with the Spanish-Italian monopolies recently. This would mean an enlargement of the world influence of the cartel. The present price-weakening action of the sales agency is ascribed partly to an intent to discourage further opening up of quicksilver mines in the United States.

The problem of electrolytic (or, as people say here, "fine") zinc, and the coming increases of output thereof in Silesia, Belgium, Canada, United States and elsewhere, have been an object of great concern on the part of the Brussels members of the zinc cartel. The percentage of output restrictions for holders of abundant stocks are to be much enhanced for Giesche-Anaconda and later on for other "fine" zinc producers, proportionate to their rate of output. What the rôle of the London zinc quotations in a "bound-up" market will be no one here dares forecast. Surely the German Bourse quotations of zinc will rapidly lose their significance. Brass manufacturers are somewhat concerned over the simultaneous heavy appreciations of both copper and zinc prices, which, according to some views, may level the path to the utilization of other alloys now being developed in Germany.

International lead producers who had a meeting in September, 1928, are now gathering statistical data (it is reported with the assistance of the United States Lead Industries Association), to be disclosed and analyzed at another meeting in March, 1929.

According to a compilation of the Francfort Metallgesellschaft, the German mine production of raw zinc in the first eleven months of 1928 was 89,376 metric tons, against 76,304 tons in the corresponding period in 1927. Lead production, including a small tonnage of hard lead, was 95,462, against 86,156 tons. The monthly average rate of electrolytic and refined copper production was 9,274 tons, against 8,717 tons. Direct smelter output of copper from ores and concentrates decreased.

As I reported some time ago, the former Metallbank has merged with the Metallgesellschaft, with assumption of the latter's name. Now the first yearly report after the fusion has appeared. The annual dividend is 8 per cent. The report says, among other things, that the volume of business has been a record since the war. The Harz smelter and the Prinz Heinrich smelter operated at a profit, and the manufacturing plants at Heddernheim, Mannheim, Nuremberg, Gustavusburg, and Cologne-Ehrenfeld were busy throughout the year.

Sales of silumin (a special aluminum alloy with good qualities) increased remarkably, and the Lurgi-Firm developed well. The Norddeutsche Affinerie, near Hamburg, distributed a 10 per cent dividend and has been able further to enlarge its copper and lead production. The Aluminium werk, at Bitterfeld (which is under the joint control of the Metallgesellschaft and I. G. Farbenindustrie, the raw aluminum capacity of which is estimated at some 5,000 tons per year, being the second producer after the Lautaweke) and the Leichtmetallwerke, at Bonn, where several aluminium application possibilities are being experimented with, likewise worked well. The company has rebought many of its own titles from English interests. A vast amount of industrial activity is covered by the Metallgesellschaft now, beyond as well as within the borders of Germany.

Imports and Exports of Ores and Metals in November, 1927 and 1928

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

Imports

Imports	November 1927	November 1928
Antimony		
Ore { Gross weight	828,263	1,105,521
Ore { Antimony content	436,920	731,747
Copper		
Ores, copper content	9,084,540	6,587,360
Concentrates, copper content	3,346,919	3,069,750
Regulus, coarse metal, cement copper	124,574	233,120
Imported from:		
Spain	573,327	755,637
Canada	5,065,467	5,260,414
Mexico	1,828,816	2,451,280
Cuba	1,241,933	937,000
Chile	3,037,922	178,473
Peru	84,587	50,275
Other countries	723,981	257,151
Unrefined black converter copper in pigs, bars, and other forms	25,381,230	49,044,348
Refined copper	9,113,627	11,258,355
Old and clippings for remanufacture	672,980	794,867
Composition metal, copper chief value	11,196	116,069
Brass, old, for remanufacture	532,094	1,694,055
Lead		
Ore and matte, lead content	6,615,766	8,583,190
Bullion or base bullion	21,829,837	25,278,388
Pigs and bars	215	7,830
Babbitt, solder and other forms, lead content	104,139	61,608
Type metal, antimonial lead { Gross weight	.....	111,994
Type metal, antimonial lead { Lead content	.....	85,675
Manganese, tons		
Cuba, manganese content	63	504
Other countries, manganese content	26,739	16,141
Pyrites, tons	32,516	45,112
Tin		
Ore, tons	10	15
Bars, blocks and pigs	10,780,162	13,934,445
Imported from:		
Netherlands	515,780	706,074
United Kingdom	1,882,204	718,617
British Malaya	8,123,551	10,104,485
Netherland East Indies	.....	93,488
Hongkong	11,179	1,553,709
Australia	123,200	80,730
Other countries	124,248	677,342
Zinc		
Ore, zinc content { Free, less 10 per cent inc.	.....	.....
Ore, zinc content { Dutiable	183,200	166,600
Blocks, pigs and old	315	346

Exports

	November 1927	November 1928
Copper		
Ores, composition, concentrates, unrefined	549,292	.....
Refined copper in ingots and other forms	70,420,876	76,364,682
Exported to:		
Belgium	9,706,118	4,240,392
France	11,101,775	13,785,869
Germany	14,409,880	14,141,515
Italy	7,375,591	11,134,296
Netherlands	8,222,802	3,617,057
Spain	369,861	296,703
Sweden	1,764,498	2,208,524
United Kingdom	11,269,243	18,607,890
Other Europe	4,854,916	475,252
Canada	399,244	3,249,705
British India	414,550	.....
China, Hongkong, Kwantung	89,600	527,300
Japan	335,906	3,224,647
Other countries	106,892	855,532
Old and scrap	4,576,862	4,353,013
Pipes and tubes	125,896	223,837
Plates and sheets	361,142	275,151
Rods	5,430,164	7,735,787
Insulated copper wire and cable	2,084,537	1,700,853
Lead		
In pigs, bars, and other forms		
From domestic ore	304,387	7,311,891
From foreign ore	16,630,926	14,143,943
Exported to:		
Belgium	56,043	.....
France	2,856,506	.....
Germany	2,184,424	1,882,989
Netherlands	1,814,872	663,286
Sweden	392,204	1,311,249
United Kingdom	5,938,095	13,556,360
Other Europe	504,033	1,000
Brasil	224,048	338,378
Other South America	459,360	585,832
China, Hongkong, Kwantung	336,482	.....
Japan	2,072,841	2,915,216
Other countries	96,405	201,524
Other lead manufactures	576,271	1,418,002
Zinc		
Ores and concentrates, tons	.....	.....
Dross	1,079,958	228,719
Cast in slabs, blocks, and pigs	4,063,688	1,427,271
Exported to:		
Belgium	225,735	22,400
France	21,512	336,009
Germany	411,870	660,941
Netherlands	305,561	42,714
United Kingdom	283,650	668,030
Japan	2,604,719	.....
Other countries	210,641	197,177
Sheets and strips, other forms	747,913	727,428
Dust	160,668	171,900
Other zinc manufactures	161,024	258,706

The Market Report

Copper at 17c. Following Heavy Sales

New York, Jan. 23, 1929—Heavy sales of copper on both foreign and domestic accounts have featured the metal markets during the past week. This large volume of business resulted in producers advancing their price to 17c., Connecticut Valley basis, late Tuesday afternoon. Lead, zinc, and tin have been quiet at unchanged prices except for a fractionally lower tin quotation. Quicksilver is stagnant, and prices continue to decline, as is true of the platinum-group metals in general.

Another Buying Spurt in Copper

Sustained demand from abroad appears to have started the latest flurry in the copper market. Sales to foreign consumers are already in excess of 50,000 tons this month, and it is not impossible that the realization of this active foreign demand served to bring domestic consumers into the market, despite the relatively unfavorable December statistics. Copper Exporters, Inc., advanced its price to 17.25c per pound, c.i.f., today.

Sales on domestic account in the last week have been about twice normal. Considerably more than half of this total was sold on Monday and Tuesday of this week. In fact, late Tuesday afternoon several sales at close to the 17c. Connecticut Valley equivalent were consummated, and most of the sellers were making no offers below that level. Today all sales agencies are quoting 17c., though the tonnage sold at this price has been very small. As has been true of most sales made during the last several weeks, April delivery has been specified on a majority of the negotiations. A fair amount of March metal was sold and a surprising tonnage for prompt and February delivery came to light. Earlier in the week one or two sellers were offering April shipment only when a corresponding tonnage for May would be taken. This sentiment rapidly disappeared as the buying activity increased, though in the aggregate a fair tonnage of May copper was sold.

Lead Marks Time

Sales of lead were of approximately the same volume as a week ago—only about half of average. Three-quarters of this business was for prompt or January shipment, and it was mostly for carloads rather than for larger lots. Consumers are apparently ordering lead only for immediate requirements, although early in the month they bought freely for February, so much so, in fact, that some producers are entirely sold out of their expected February production, and must cut further into reserve stocks. Cable and battery manufacturers have shown little interest in the market the last week, most of the orders being booked for the account of small users of lead for diversified purposes.

Prices in the East are firm on the basis of 6.65c., New York, which is the contract price of the American Smelting & Refining Company. In the West, most of the business has been done at the unchanged price of 6.50c., St. Louis, though in the last three days offerings have been made for the account of smaller producers at 6.475c., with some acceptances of metal at that level. The larger interests continue firm, however, and are even quoting 6.55c. for March shipment. The foreign market continues somewhat disappointing, but London prices are not expected to weaken sufficiently to compel a downward revision of prices here; so far as the purely domestic situation is concerned, an upward price trend would seem justified.

Zinc Market Extremely Dull

Sales of Prime Western zinc during the last week were even scarcer than in the preceding week. In fact, the total tonnage is less than in any corresponding period since early in October. The

Daily Prices of Metals

Jan.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
17	16.525	49.375	6.65	6.50	6.35
18	16.525	49.00	6.65	6.50	6.35
19	16.525	49.00	6.65	6.50	6.35
21	16.525	48.875	6.65	6.475@6.50	6.35
22	16.575	49.00	6.65	6.475@6.50	6.35
23	16.775	48.875	6.65	6.475@6.50	6.35
	16.575	49.021	6.65	6.494	6.35

Average prices for calendar week ending Jan. 19, 1929, are: Copper, 16.525; Straits tin, 49.104; N. Y. lead, 6.650; St. Louis lead, 6.500; zinc, 6.350; and silver, 57,042.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
17	74 13/16	72 11/16	78 1/2	223	222 3/8	22 1/16	22 3/16	26 1/16	26 1/16
18	75 1/16	73 3/8	78 1/2	224 1/8	223 1/2	22	22 1/16	26 1/16	26 1/8
21	75 3/8	75 1/16	78 1/2	222	221 1/2	22 1/4	22 3/8	26 1/16	26 1/16
22	75 11/16	75 1/2	78 1/2	223	222 3/8	22 3/16	22 1/4	25 7/8	25 13/16
23	76 1/16	74 1/4	79 1/2	223	222 3/8	22 1/16	22 1/8	25 3/4	25 11/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.84 9/16	56 3/4	26 1/8	84s11 1/2d	21	4.84 1/2	56 7/8	26 3/16	84s11 1/2d
18	4.84 5/8	56 3/4	26 1/16	84s11 1/2d	22	4.84 9/16	56 3/4	26 1/8	84s11 3/8d
19	4.84 1/2	56 5/8	26 1/16	.....	23	4.84 9/16	56 5/8	26 1/16	84s11 1/2d
					Ave.	56.771			

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

price, however, continues firm at 6.35c. per pound East St. Louis. Sellers, in general, are in fairly good condition, despite the recent extremely inactive demand, as they sold an unusually large tonnage for delivery in the first half of 1929 during the tremendous November buying wave.

Tin Still Around 49c.

The tin market has been quiet at substantially unchanged prices, around 49c. all week, and for all positions. The Anglo-Oriental group in London continues to control the market, holding prices within a narrow range.

This feature of the tin market has had a most unfortunate effect on the popularity and general acceptance of the new National Metal Exchange, which has found the stabilized market particularly unsatisfactory from a speculative standpoint. One of the latest quirks of the London bull group is the shipping of tin to unlisted warehouses in the United States, whereupon it appears in the statistics as having entered consumption. This particular scheme had been attempted in England recently, but the current utilization of unlisted warehouses in the United States for this purpose is new.

Deliveries in January will probably be smaller than expected, even with the metal going to warehouses included.

Silver Weak and Lower at 56⅝c.

Weakness in China exchanges with sales by China have further depressed silver, the London price being quoted 26 7/16d. and New York 56⅝c., which is the lowest price quoted since Feb. 6, 1928. Reports from abroad state that India has been a good buyer at the lower level, and moderate orders have been received in the local market from the same source. The tendency is uncertain.

Mexican Dollars (Old Mexican pesos): Jan. 17th and 18th, 43c.; 19th and 21st, 43⅛c.; 22d, 43c.; 23d, 42⅞c.

London Shipping Gold to U. S.

Owing to the continued low rate of sterling exchange and the differential in interest rates between New York and London, a flow of gold seems likely westward across the Atlantic, the "Aquitania" being loaded with $2,500,000 today, the first shipment since Nov. 13. Closing cable quotations on the principal foreign exchanges on Tuesday, Jan. 22, were: Francs, 3.90¼c.; lire, 5.23¼c.; and marks, 23.76¼c. Canadian dollars, 31/128 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.: 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, 9½c. per lb. for spot; 9⅜c. per lb. for futures. Cookson's "C" grade, spot, 14¾c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 80@95c. Active demand.

IRIDIUM—Per oz., $260@$265 for 98 @99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $38@$40. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $70. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $119 cash. Small lots command the usual premiums. Market quiet.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Jan. 5.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: wolframite, $12; Western scheelite, $12@$12.50.

Chrome, Iron, Manganese, Tantalum, Titanium, and Vanadium ores are unchanged from quotations in the Jan. 5 issue.

Zinc Concentrates Reported Advanced $1 per Ton

Joplin, Mo., Jan. 19, 1929

Blende	Per Ton
High	$42.30
Premium blende, basis 60 per cent zinc	$41.00@ 42.00
Prime Western, basis 60 per cent zinc	39.00@ 40.00
Fines and slimes, 60 per cent zinc	36.00@ 38.00
Average settling price, all zinc	39.73
Galena	
High	$89.10
Basis 80 per cent lead	87.50
Average settling price, all lead	86.67

Shipments for the week: Blende, 12,721; lead, 1,685 tons. Value, all ores the week, $651,520.

A report, the authenticity of which cannot be questioned, was circulated today that one buyer, out of the market several weeks, stepped in today with offers on a few lots of extra premium grade concentrate at $1 above the price current the last six months.

Authoritative reports are to the effect that the zinc concentrate selling agency is perfected, with signators representing 350,000 tons of ore annually.

Platteville, Wis., Jan. 19, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$87.00

Shipments for the week: Blende, 584 tons; lead, none. Shipments for the year: Blende, 2,068 tons; lead, 40 tons. Shipments for the week to separating plants, 1,138 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Jan. 5 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Market firm.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Jan. 5 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $33@$34 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.04@$1.10.

NICKEL SILVER — Price for 18 per cent Grade A sheets, advanced to 32c. from 31¾c. per lb. Jan. 23.

YELLOW (MUNTZ) METAL—Price for dimension sheets advanced to 22½c. from 22¼c. per lb.; for rods advanced to 19½c. from 19¼c. per lb. Jan. 23.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Jan. 5 issue.

Rolled Metals

COPPER—Price for sheets, hot rolled, advanced to 26⅛c. from 25⅞c. per lb. Jan. 23; for wire, advanced to 18⅞c. from 18⅝c. per lb. Jan. 22.

LEAD SHEETS—Full-rolled sheets 10½c. per lb.; clipped sheets 10¾c. per lb.

Monel Metal, Nickel, and Zinc Sheets are unchanged from prices in the Jan. 5 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Jan. 5.

Iron, Steel and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $18.25; basic, $17.50@$18; No. 2 foundry, $17.50@$18.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per lb., 1.90@2c.

Coke—Per gross ton, Connellsville furnace, $2.75. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Weeks Ending Jan. 12 and 19, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	122⅛	115½	122	Ja. 2, Fe. 18	Q 1.50
Andes Copper	New York	51½	48½	49⅜	No. 15, De. 17	I 0.75
Arizona Com	Boston	5½	4½	4⅝	Ja. 16, Ja. 31	S.A. 0.25
Calumet & Ariz	New York	128⅜	121⅛	124⅛	De. 1, De. 17	QX 2.50
Calumet & Hecla	Boston	49	44½	48⅛	No. 30, De. 15	Q 1.00
Cerro de Pasco	New York	108½	101⅞	103⅛	Ja. 11, Fe. 1	Q 1.25
Chile Copper	New York	85½	71⅜	85⅛	De. 5, De. 27	Q 0.75
Con. Coppermines	N. Y. Curb	15	13⅜	14⅜		
Copper Range	Boston	27½	26	26	De. 15, Ja. 15	Q 0.50
East Butte	Boston	4	3½	3½	Dec., 1919	0.50
Granby Con	New York	89	85	87⅜	Ja. 4, Fe. 1	Q 1.50
Greene Cananea	New York	178½	168	175½	De. 1, Ja. 7	Q 1.50
Howe Sound	New York	72	66½	69	De. 31, Ja. 5	Q 1.00
Hudson Bay	N. Y. Curb	21⅛	19⅞	21		
Inspiration	New York	46½	43½	45	De. 20, Ja. 7	Q 0.75
Isle Royale	Boston	26½	25	25⅜	Fe. 28, Ma. 30	0.50
Kennecott	New York	159⅛	150½	154⅜	No. 30, Ja. 2	Q 2.00
Magma Copper	New York	69⅜	66	67½	De. 31, Ja. 15	Q 1.00
Mason Valley	N. Y. Curb	2⅜	1⅞	1⅞		
Miami Copper	New York	33¼	30⅛	33	Fe. 1, Fe. 15	Q 0.50
Mohawk	Boston	47	41	46⅛	Ja. 26, Ma. 1	Q 1.50
Mother Lode	New York	3½	3½	3½	De. 14, De. 31	0.20
Nevada Con	New York	43¼	39⅜	41⅜	De. 14, De. 31	Q 0.50
New Cornelia	N. Y. Curb	42⅛	40⅞	41⅜	Fe. 1, Fe. 18	Q 0.50
Noranda	N. Y. Curb	66	60⅜	62⅛		
Ohio Copper	N. Y. Curb	4	1⅜	4	Sept., 1926	0.03
Old Dominion	Boston	18⅛	16½	17⅜	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	217	207½	208	De. 18, Ja. 2	Q 2.50
Quincy	Boston	48½	45	45⅛	March, 1920	1.00
Roan Antelope	N. Y. Curb	47⅜	40	45⅛		
St. Mary's M. L.	Boston	37⅜	34½	35	No. 20, De. 1	1.00
Seneca Copper	New York	6¼	5⅜	6		
Shattuck Denn	N. Y. Curb	23	21½	22⅛		
Sherritt-Gordon	Toronto	7	5	7		
Tenn. C. & C.	New York	18⅜	17⅛	17⅜	Au. 31, Se. 15	Q 0.25
United Verde Ex	N. Y. Curb	23½	20½	20⅜	Ja. 4, Fe. 1	0.75
Utah Copper	New York	293	290	290	De. 14, De. 31	Q 3.00
Waite-Ack.-Mont.	Toronto	2.35	2.35	2.35		
Walker Mining	Salt Lake	2.62½	2.47½	2.55		
Wenden Copper	N. Y. Curb	2⅛	2⅛	1⅛		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	4	3⅜	4		
Amer. Z. L. & S.	New York	42½	38½	41⅛	May, 1917	1.00
A. Z. L. & S., pfd.	New York	106	103½	106	Nov., 1920	1.50
Bingham Mines	Boston	55	50½	54⅜	De. 20, Ja. 5	Q 0.50
Bunker Hill & S.	N. Y. Curb	145	137½	145½	Oc. 31, No. 5	X 0.75
Butte Cop. & Zn.	New York	9½	8½	9	De. 14, De. 31	Q 0.50
Butte Cop. Con.	Boston Curb	1⅜	*98	1		
Butte & Sup.	New York	12	10⅛	10⅛	Se. 14, Se. 29	Q 0.50
Callahan Zn-Ld.	New York	3⅜	3	3⅛	Dec., 1920	0.50
Castle-Trethewey	Toronto	*39	*37	*39		
Chief Consol.	Salt Lake	†4.10	†3.60	3.75	Ja. 10, Fe. 1	K 0.10
Consol. Ld. & Zn. "A"	St. Louis	11	10⅛	10⅛	Ja. 1	0.25
Constitution	Spokane	*40½	*32	*35½		
Dayrock	Spokane	1.65	1.50	1.60		
Dickens Consol	Spokane	*18½	*15	*17½		
Duthie Mines	Spokane					
Eagle-Picher	Cincinnati	21	20⅜	20⅜	No. 15, De. 1	Q 0.40
Eagle-Pich., pfd.	Cincinnati			110	July 15	Q 1.50
Erupcion	Boston Curb	*25	*24	*25	Ja. 1, 1928	Q 0.07½
Eureka Bullion	Salt Lake					
Eureka Lily	Salt Lake	1.40	1.22½	1.32½		
Eureka Standard	Salt Lake	5	5	5		
Evans-Wallower	N. Y. Curb	21⅞	15½	21⅞		
Evans-Wal., pfd.	N. Y. Curb	21⅞	18⅜	21⅞		
Federal M. & S.	New York	250	234	249	Je., 1927	10.00
Fed. M. & S., pfd.	New York	100⅜	100¼	100¼	No. 23, De. 15	Q 1.75
Gladstone	Spokane	*14¼	*7	*11¼		
Golconda	Spokane	*84	*20	*20		
Grandview	Spokane	*85	*56	*81		
Hecla Mining	N. Y. Curb	17½	16⅜	17	No. 13, De. 14	Q 0.15
Highland-Surprise	Spokane	*15½	*13	*14		
Keeley	Toronto	*48	*34	*48	Mr. 1, Mr. 15	SA 0.04
Jack Waite	Spokane	*18½	*16⅜	*16⅜		
Kootenay Florence	Spokane	*29	*21	*27		
Lucky Jim	Spokane	*24½	*22	*24		
Lucky Tiger-C.	Kansas City	†6.65	†6.25		De. 4, De. 20	MX 0.87
Mexican Premier	Spokane	*90	*83	*84½		
Mining Corp.	Toronto	4.75	4.05	4.65	De. 6, De. 20	SA 0.01½
National Lead	New York	158½	147½	150⅜	De. 14, De. 31	Q 1.25
Natl. Lead, pfd. A	New York	140½	140	140	Ma. 1, Ma. 15	Q 1.75
Natl. Lead, pfd. B	New York	119½	118	119	Ja. 18, Fe. 1	Q 1.50
N. J. Zinc	N. Y. Curb	304½	279½	300	No. 20, De. 10	X 2.00
New Quincy	Salt Lake	1.45	1.35	1.42½		
Nipissing	N. Y. Curb	3¼	3⅛	3⅛	De. 21, Ja. 21	Q 0.07
Noble Five	Spokane	*80	*62	*70		
North Lily	Salt Lake	8.25	7.90	8.00	Oct. 20	I 0.20
Park Bingham	Salt Lake					
Park Utah	New York	12⅛	11⅛	11⅛	De. 31, Ja. 2	Q 0.20
Pend Oreille	Spokane	*14	*10	*14		
Rico Argentine	Salt Lake	*46½	*46	*46	No. 30, De. 15	Q 0.03
Ruth-Hope	Spokane	*68	*58	*61		
St. Joseph Lead	New York	91⅛	62	90½	Ma. 8, Ma. 20	QX 0.75
Sherman Lead	Spokane	*23	*20	*20		
Silver King Con.	Salt Lake	13.37½	12.87½	13.00	De. 15, Ja. 2	QX 0.35
Silversmith	Spokane	*12⅛	*8½	*12	Oct., 1926	Q 0.02
Sunshine Mining	Spokane	1.59	1.42	1.48	De. 20,	BM 0.02
Tamarack-Custer	Spokane	*38½	*33½	*33½	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.37½	14	14.25	De. 23, Ja. 23	X 0.20
Tonopah Belmont	N. Y. Curb	1⅜	1	1⅛	Oct., 1925	0.05
Treadwell-Yukon	Toronto	12⅛	11⅛	12		
United Zinc Smg.	N. Y. Curb	1⅛	1⅛	1⅛		
Utah Apex	Boston	4⅛	3⅛	3⅛	Je. 14, Au. 1	K 0.25
Utah Met. & Tun.	Boston	1⅛	1	1	Dec., 1917	0.30
Whitewater	Spokane	1.45	1.30	1.35		
Yellow Pine	Los Angeles	*23	*23	*23	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	10⅛	8⅛	9⅛		
Barry-Hollinger	Toronto	*40	*31	*33		
Central Manitoba	Toronto	*75	*64	*70		
Coniaurum	Toronto	2.50	2.00	2.15		
Cresson Consol.	N. Y. Curb	1⅜	*72	1⅛	Oc. 15	Q 0.02
Dome Mines	New York	10⅜	9⅛	9⅜	De. 21, Ja. 21	Q 0.25
Golden Cycle	Col. Springs	†1.53	†1.51		No. 30, De. 10	Q 0.04
Gold Hill	Toronto	*8⅛	*5⅛	*5⅛		
Hollinger	Toronto	9.55	8.75	9.00	De. 12, De. 31	M 0.05
Homestake	New York	79½	75	75	Ja. 19, Ja. 25	MX 1.50
Kirland Lake	Toronto	1.83	1.58	1.76		
Lake Shore	Toronto	20½	18⅜	19	De. 1, De. 15	QX 0.40
McIntyre-Porc.	New York	23⅛	21	23⅛	Fe. 1, Ma. 1	Q 0.25
Portland	Colo. Springs	†*11	†*9		April, 1927	0.02
Rand Mines	New York			37⅛	Au. 21, '28	Am.Sh. 1.52
Siscoe	Toronto	†1.60	†1.55			
Sylvanite	Toronto	2.25	2.02	2.05		
Teck-Hughes	Toronto	9.25	8.85	9.05	Ja. 31, Fe. 1	0.15
Tom Reed	Los Angeles	*25	*22	*24	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅜	1⅛	1⅛		
Vipond Consol.	Toronto	1.25	1.00	1.14	April, 1927	0.03
West Dome Lake	Toronto	*89	*89	*89		
Wright-Hargreaves	Toronto	2.50	1.48	2.00	Oc. 16, No. 1	Q 0.02½
Yukon-Alaska	N. Y. Curb					
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	19⅛	19⅛	19⅛		
Cent. American	N. Y. Curb					
Consol. Cortez	N. Y. Curb	*25	*18	*25		
Dolores Esperanza	N. Y. Curb	*87	*76	*87	July, 1923	0.05
Montana-Idaho	Spokane	*11⅛	*10⅛	*10⅛		
N. Y. & Hond. Ros.	N. Y. Curb	16⅛	15⅛	16⅛	Ja. 16, Ja. 26	X 0.05
Premier Gold	N. Y. Curb	2⅛	2 1/16	2⅛	De. 14, Ja. 4	0.06
Tonopah Exten.	N. Y. Curb	*28	*8	*21	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3¼	3⅛	3 1/16	Se. 29, Oc. 20	SA 0.07½
United Eastern	N. Y. Curb	*86	*80	*86		
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	87⅛	82⅛	86⅛	Jl., 1924	1.25
Beth. Steel, pfd, 7%	New York	123	121½	122		
Cleveland-Cliffs	Cleveland	148	130	147	Ja. 15, Ja. 25	QX 2.00
Colo. Fuel & Iron	New York	73⅜	66⅛	71	Au. 10, Au. 25	Q 2.00
Colorado F. & I., pfd.	New York					
Great Northern Iron	New York	30½	27⅜	30⅛	Ap. 9, Ap. 30	K 0.75
Inland Steel	New York	89	79½	88⅛	No. 15, De. 1	Q 0.62½
Republic I. & S.	New York	86⅜	81	86	Fe. 13, Ma. 1	Q 1.00
Republic I. & S., pfd.	New York	110	108⅞	110	Ma. 11, Ap. 1	Q 1.75
Sloss-Sheffield S. & I.	New York	125	120	125	De. 20, Ja. 2	Q 1.75
Sloss-Sheff. S. & I., pfd.	New York	112	108	112	Se. 20, Oc. 1	Q 1.75
U. S. Steel	New York	189	164⅛	188⅜	No. 30, De. 29	Q 1.75
U. S. Steel, pfd.	New York	141⅛	141⅛	141⅛	No. 3, No. 28,	Q 1.75
Virginia I. C. & C.	New York			25	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	47⅛	47	47⅛	Jl. 16, Jl. 2,	SA 2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	170	146	161⅛		
Alum.Co.of Amer., pf.	N. Y. Curb	105½	104½	105	No. 20, De. 9,	Q 0.75
American Metal	New York	73⅛	60½	69		
Amer. Metal, pfd., 6%	New York	126½	120	121	No. 20, De. 1,	Q 1.50
Amer. Sm. & Ref.	New York	288	287⅞	287⅞	Oc. 11, Oc. 11,	Q 2.00
Amer. Sm. & Ref., pfd.	New York	137¼	137	137	Fe. 1, Ma. 1	Q 1.75
Amer.Sm.& Ref., new	New York	98	93⅛	94⅛		
Ang. Ch. Nitrate	N. Y. Curb	44⅛	33	43⅛		
Asbestos Corp.	Montreal	17	17	17	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	62	60	62	De. 31, Ja. 15	Q 1.75
Consol. M. & S.	Montreal	385	379	385	De.31,Ja.15,SA	X 6.25
De Beers Consol.	New York			23	Ja. 19, Ja. 26,	0.48
Federated Metals	N. Y. Curb	36	34⅛	35⅛		
Freeport Texas	New York	54½	50⅛	51	Ja. 15, Fe. 1	Q 1.00
Int. Nickel Can.	New York	66⅞	52½	65	De. 13, De. 31	Q 0.75
Int. Nicke., pfd.	New York			120	Ja. 18, Fe. 1	Q 1.75
Newmont	N. Y. Curb	202	193⅛	195	De. 28, Ja. 15	Q 1.00
Patiño M. & E.	New York	39⅜	34⅛	36⅛	Aug. 1928	4s.
So. America G. & P.	N. Y. Curb	3⅜	3	3		
Texas Gulf Sulphur	New York	79¼	76	77⅛	De. 1, De. 15	Q 1.00
U. S. Sm. R. & M.	New York	70⅜	61⅛	66⅛	De. 31, Ja. 15	Q 0.87½
U. S. Sm. R. & M., pfd.	New York	57⅛	56⅛	56⅛	De. 31, Ja. 15	Q 0.87½
Vanadium Corp.	New York	113⅛	95⅛	110⅛	Fe. 1, Fe. 15	Q 0.75

Toronto Standard Stock Exchange, Toronto, courtesy Arthur E. Moysey & Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Spokane Stock Exchange, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, four weeks. K, Irregular. I, Initial. X, Extra. The first data given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEKS ENDING JANUARY 1 and 8, 1928

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	17/6	17/—	17/6		
Alaska Treadwell (25)	50/—	40/—	50/—	Nov., 1926	4 (d)
Armayo Mines (25 frs.)	69/9	64/9	68/9	Nov. 1928	5 (c)
Burma Corp (10 rupees)	20/6	15/6	19/6	Feb., 1929	7* annas
Bwana M'Kubwa (5s)	16/10½	13/—	16/4½		
Camp Bird (2s)	4/1½	3/4½	3/10½	April, 1928	1⅜
El Oro (£1)	5/4½	4/7½	5/3	Nov., 1924	2½*
Frontino & Bolivia (£)	8/9	8/4½	8/9	July, 1928	3½
Mexican Corpn. (£1)	10/4½	9/4½	10/3		
Mexican Mines of El Oro (£1)	25/—	20/—	22/6	Dec., 1926	3½*
Mond Nickel	225/7½	170/—	221/3	Feb., 1929	18½
Mount Isa (£)	34/3	33/1½	33/9		
N'Changa Copper Mining	39/6	28/—	39/—		
Oroville Dredging (4s)	3/3	2/10½	3/—	Nov., 1928	31½
Rhodesian Congo Border (£1)	63/9	49/9	63/9		
St. John del Rey (£1)	12/—	11/9	11/9	Dec., 1928	2½
San Francisco Mines (10s)	35/1½	30/3	33/6	Jan., 1929	25
Santa Gertridia (£1)	14/9	13/7½	14/3	Jan, 1928	7½
Selukwe (2s. 6d.)	7/10½	7/1½	7/6	April, 1927	6¾
S. Amer. Copper (2s.)	3/—	2/—	2/10½	Nov. 1917	75
Tanganyika (£1)	66/6	58/9	63/9	July, 1928	5
Union Miniere de Haut-Katanga (Brussels)	11,735	11,100	11,700	July, 1928	182.60

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.